

REPORT
OF THE
AGRICULTURAL EXPERIMENTS AND
DEMONSTRATIONS

IN
ASSAM

FOR
NINE MONTHS ENDING THE 31ST MARCH 1919.



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Report of the Jorhat Agricultural Experiment Station for nine months ending the 31st March 1919.

1. *Introduction.*—This station is situated about 3 miles south of Jorhat, Sibsagar district, Assam Valley, and was established in the beginning of the year 1906. It was intended principally for sugarcane work. Since then, on account of peculiar soil conditions which altogether precluded the growth of most *rabi* crops even in the presence of abundance of soil moisture, the work has been extended to include a study of the factor causing this sterile condition with a view to its amelioration. This work has been going on since 1908, and we are now in a position to state that the sterile condition of the soil to most crops in the cold weather, and also to certain crops in the rains, is due to the accumulation of acid substances, amongst them being a specific toxin which has been isolated and experimented with in culture solutions, with effects on the plant's root system and growth precisely similar to those observed in the field; these are readily neutralised and rendered harmless by dressings of lime or other base to the soil. An account of the experimental results leading up to this conclusion has been published as a memoir of the Department of Agriculture in India, Chemical Series, Volume III, No. 9, entitled "Studies of an acid soil in Assam."

In connection with the improvement of the soil by liming, the application of other fertilizers has been studied, and our regular scheme of manuring now includes green manuring and the application of raw phosphates. Phosphoric acid has an effect second only to that of lime on these soils, but is preferably used in a basic form such as basic slag, for instance, rather than in the form of acid superphosphate. While small initial applications of the latter act beneficially, its application in very large doses or its continued use over a number of years in our own experience is clearly detrimental in the absence of periodic lime dressings on sour soils. If used in conjunction with lime, however, the case is quite a different one.

The original area of the station was about $35\frac{1}{2}$ acres, of which 1.7 acres is *hola* or ravine land and the remainder high land, which was under grass and scrub jungle at the time of acquisition. An additional area of about 24 acres has since been acquired, of which about 4 acres is *hola* land and the remainder high land.

The total area at present is thus $59\frac{1}{2}$ acres. Most of the newly-added area has been put under cultivation and is being treated uniformly in blocks with a view to future experiments.

2. *Soil*.—The soil of the high land is a reddish sandy loam of the old alluvium, lying on a hard greyish yellow sub-soil. Where the conditions have not been improved by cultivation, the soil is extremely shallow, varying from only 3 to 6 inches in depth.

The following report is by Mr. A. A. Meggitt, Agricultural Chemist, Assam :—

Report on analysis of Jorhat Farm soil.

	Surface soil.		Sub-soil.	
	Laboratory No. 5.		Laboratory No. 5(a).	
1	2		3	
A	Per cent.		Per cent.	
<i>Soluble in Hydrochloric acid with 12 hours' digestion at 100° C.</i>				
Phosphoric acid (P ₂ O ₅)	0.025	0.020
Potash (K ₂ O)	0.115	0.135
Lime (CaO)	0.154	0.144
Magnesia (MgO)	0.166	0.148
B				
<i>Soluble in one per cent. citric acid with 7 days' digestion.</i>				
Phosphoric acid	0.008	0.008
Potash	0.007	0.011
C				
Loss on ignition (organic matter and combined water)	3.26	1.84
Nitrogen	0.115	0.051
Calcium carbonate	0.018	0.018
Reaction	Acid	Acid.

These analyses agree quite well generally with some others made some years ago by the Imperial Agricultural Chemist.

These samples are acid in reaction, and the total lime present in all combinations, as well as the carbonate of lime, is quite deficient in quantity.

The amount of organic matter is probably greater than obtains in many Indian soils, but there is no doubt that a light soil of this character will be much improved in many ways by an increase in the amount of humus.

A good deal of the organic matter present is of a double character and consists very probably of very old residues of little value; it is the presence and active decay of comparatively recent additions of organic matter which puts life into a soil.

The percentage of nitrogen present in the surface soil is what would normally be considered a fair one, but in view of the absence in anything like adequate quantity of carbonate of lime, conditions for nitrification and soil bio-chemical processes generally are probably not as favourable as they might be by a long way, and an increase in the amount of nitrogen is indicated as desirable.

Of potash there is no dearth, and there would seem to be no immediate need for potash manuring.

Regarding phosphoric acid, these samples show a deficiency both in "total" as well as "available" supplies. There is thus a "real" as opposed to a mere temporary lack in respect of this element of plant food.

This lack of phosphoric acid is further aggravated by the absence of sufficiently large amounts of lime carbonate and humus, high percentages of which may, and often do, offset a smaller percentage of phosphoric acid.

An acid condition of soil, besides being harmful in itself, very often brings about a more rapid depletion of the soil's stock of phosphoric acid, in consequence of which most soils of a decidedly acid character are found to be lacking in this element and to respond to its suitable application.

The sub-soil is capable of very great improvement indeed as the figures show, but it would probably be immediately disastrous to work it so deeply as to bring any considerable amount to the surface at once.

The growth of deep-rooting legumes as green crop will assist materially, but if the sub-soil could be stirred occasionally, while at the same time the surface cultivation is gradually deepened so that the green crops may be more deeply buried, a greater depth of surface soil will result, which on this farm is very much to be desired.

I am convinced that for cane cultivation, until the surface soil has been deepened and the amount of humus increased, it is of little use attempting manurial experiments on cane with artificial manures. No amount or combination of the latter can ever make up, in the case of a crop like sugarcane, for loss of fertility due to shallow cultivation and lack of "humus".

3. *Buildings, machinery, etc.*--The farm is equipped with a godown, combined office and rest house, Farm Manager's bungalow, clerks and apprentices' quarters, cattle shed, Dutch barn, and is enclosed by "Ideal" wire fencing.

A Hornsby oil engine and crushing mill capable of dealing with 1 ton cane per hour was installed in 1911 and has given every satisfaction since.

The only new construction work carried out during the year was the erection of a cattle manure shed with wooden posts, thatched roof and mud walls at a cost of Rs. 120, and two additional coolie huts costing Rs. 85 altogether.

The new manure shed is entirely above ground. Previously manure was stored in pits covered by a shed, but this practice has been discontinued owing to the difficulty of preventing sub-soil water from flooding the pits.

4. *Rainfall.*--The rainfall recorded during the year under report is given below together with the normal rainfall :—

Month.			Actual (inches).	Normal (inches.)
1918 April	...	...	4.90	8.54
" May	...	...	12.11	9.26
" June	...	...	17.25	11.36
" July	...	...	19.62	14.76
" August	...	...	18.75	15.15
" September	...	...	12.03	9.18
" October	...	...	2.89	4.07
" November	...	...	Nil	0.69
" December	...	...	0.28	0.52
1919 January	...	...	0.15	0.93
" February	...	...	0.99	1.32
" March	...	...	0.72	3.90
Total			89.70	79.68

The rainfall was in defect up till June, but from then on till September was in excess and the temperature was lower than usual; in fact it was not "good growing weather" for cane. From the middle of October until the end of the year under report the weather was exceptionally dry, the total rainfall for this long period only amounting to just over two inches.

5. *Experimental work*.—The work of previous years was continued and extended as follows:—

- I. Sugarcane experiments, including varietal, manurial planting and testing of new varieties.
- II. Soil investigations and manurial experiments.
- III. Trials of pulse crops.
- IV. Trials of fodder crops.

6. *Sugarcane*.—This work includes the testing of varieties under chemical control, manurial experiments in the cane rotation, trials of various methods of planting, and the distribution of the best varieties to selected cultivators. This year 64,000 sets were distributed from the farm.

Generally speaking the season was not very favourable for cane. The early months were hot and dry followed by a wetter and colder rainy season than usual. The cold weather was abnormally dry.

In last year's report mention is made of a fungus disease *Melanconium Sacchari* which did serious damage to the 1917-18 crop. This disease was found to attack as a rule only canes injured by "borer" or by "lodging." This year a vigorous campaign against borers was carried on throughout the season with the result that the amount of cane damaged by this pest was very much less than usual, and in consequence the fungus disease was kept in check and did very little harm to the crop.

7. *Sugarcane varieties. Ratoon cane*.—The following varieties planted in Block D in February 1917 were ratooned:—B147, Striped Mauritius, B376, Barbadoes A and B-6450 on both phosphated and non-phosphated areas, B3412, J33a and Barbadoes B on the phosphate area only and Magh and Magh Sport, on the non-phosphate area only. The results of the plant cane crop were given in paragraph 8 of last year's report.

As in previous years the trash from the plant cane was burnt on the field, and the young ratoons were given frequent inter-cultivation and two earthings. The crop received 2,400 lbs. rape cake per acre applied in two equal dressings at the times of earthing.

The crop was harvested in February 1919. The results are set out in Table I.

Striped Mauritius gave the biggest crop and the largest out-turn of sugar. B-376 was a little below its average in yield probably owing to the severe attack of *Melanconium Sacchari* on the plant cane last year. B-147 was even worse than last year as a ratooner; this variety undoubtedly appears to be losing its vitality. The following figures compare this year's crop with the average of the previous five years:—

Variety.	Lbs. of cane per acre.	
	Season 1918-19.	Average of previous 5 years.
B-147 ratoon ...	30,142	40,792
Striped Mauritius ratoon	66,082	61,368
B-376 ratoon ...	48,915	53,408

It is evident from this that Striped Mauritius is more than maintaining its position as to the best ratooning variety, while B-147 has fallen off seriously in this respect.

Of the newer varieties Barbadoes A, B-3412 and J-33a gave big crops. Their sucrose content is, however, low and they are all characterised by an undesirably high glucose ratio and a low co-efficient of purity of juice. The best of the three is J-33a which, except for its hardness, would appear to be a promising cane from the cultivator's point of view, as it stands up to adverse conditions very well.

Another new variety, viz., B-6150, while not cropping heavily, gave a very rich and pure juice.

The local varieties Magh and its sport compare very unfavourably with all the introduced varieties; as will be seen from the figures.

Phosphate area.—As was the case in the plant cane on this Block last year, so again this year the phosphate plots showed a slight decrease in weight of canes fit for milling as compared with the non-phosphate plots. The decrease this year amounted to an average of 2.1 tons per acre. The phosphate area suffered very badly last year from the disease *Melanconium Sacchari* and the decrease in the ratoons this year is probably to be explained by this.

TABLE I.
Block D. *Ratoon cane* 1918-19. *Varieties.*
(Figures are per acre.)

Variety.	Plot No.	Plot area.	Cane (lbs. per acre.)	Juice (lbs. per acre.)	Express- ion; juice (canes).	Sucrose sugar in juice.	Invert sugar in juice.	Glucose co-efficient of juice.	Purity co-efficient of juice.	Sucrose per acre in expressed juice.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12
B-117	1	1 ¹ / ₂ th	30,740	18,220	59.3	16.30	0.76	4.93	90.0	2,970	The (a) plots were on the phos- phated area. A great deal of damage was caused by rats in certain plots totally in Nos. 2a and 3a and to a less extent in No. 3. The cane in these plots was lodged and the rats were very numerous, providing food cover for the rats. Varieties which did not lodge were very little dama- ged.
Striped Mauritius	2	"	29,545	16,136	56.9	16.14	0.76	4.75	91.1	2,669	
	3	"	70,830	42,720	60.2	16.01	0.70	4.14	91.2	7,234	
	4	"	61,275	40,460	66.0	15.88	0.81	5.72	90.3	6,424	
B-376	5	"	60,260	31,935	63.5	15.00	0.80	6.02	89.4	4,790	
	6	"	47,586	30,610	64.3	14.34	1.05	7.34	88.4	4,860	
	7	"	66,350	42,250	63.6	15.45	1.05	15.70	81.2	5,980	
Barbadoes A...	8	"	63,240	38,275	60.5	11.70	3.07	17.74	76.9	4,478	
	9	"	46,910	31,065	66.2	17.21	0.67	3.89	90.1	5,356	
B-6450	10	"	30,436	25,600	64.8	16.49	0.75	4.77	90.4	4,220	
B-3412	11	"	40,030	43,610	63.1	15.37	1.88	15.24	81.8	5,395	
J-33a	12	"	74,840	44,720	59.7	13.74	1.87	13.62	81.5	6,145	
Barbadoes B...	13	"	40,780	25,065	63.9	13.71	1.61	11.77	81.4	5,361	
Magh	14	"	17,245	19,652	61.3	15.20	0.93	6.08	83.1	1,618	
Magh Sport...	15	"	21,215	11,706	55.5	15.61	0.93	6.35	87.2	1,830	

8. *Sugarcane varieties—Plant cane—Block E.*—Following the usual rotation this block was given in 1917 a dressing of ground limestone at the rate of 1,600 lbs. per acre over the whole area, and 560 lbs. of Flour Phosphate on the one acre which received a similar dressing in 1913. The cropping in 1917 was Cowpeas ploughed in for green manure followed in the autumn by a crop of rape which was also ploughed in. The land was then fallowed until March 1918 when the cane was planted. Both Cowpeas and rape made much bigger crops on the area which received phosphate in addition to limestone.

The following ten varieties were planted in duplicate plots on both phosphate and non-phosphate areas—B-147, Striped Mauritius, B-376, Barbadoes A, B-6450, B-3412, Magh Sport, J-33a, Barbadoes B, and Magh. White Mauritius, a local Sport of Striped Mauritius, occupied a plot on the non-phosphate area only. The area of each plot on the non-phosphate area was $\frac{1}{20}$ acre and on the phosphate area $\frac{1}{30}$ acre.

All plots were given the same cultivation and manuring, which consisted of 20,000 lbs. cowdung per acre at planting time, 10,000 lbs. cowdung at the first time of earthing and 560 lbs. groundnut cake (N. equiv. 10,000 lbs. cowdung) at the second time of earthing.

The results are shown in Tables II and III.

The season was not so favourable as in the previous year and the average crop over the whole area is somewhat less in consequence, being 27.5 tons stripped cane per acre, as against 33.1 tons per acre last year. It is satisfactory evidence, however, of the soundness of the rotation that, four years ago when this block was last under plant cane, the average crop was only 22.5 tons per acre.

The older varieties Striped Mauritius and B-376 again yielded very heavy crops, but B-147 was much below its average.

Of the newer varieties Barbadoes A, B-3412 and J-33a again gave high yields, but, with the exception of J-33a, their sucrose content and purity were disappointing. They, however, ripened off their juice much better than last year, and some of them may yet acclimatise to our conditions. B-6450, while showing a high sucrose content and purity, did not produce a heavy crop. White Mauritius, a Sport which we have separated from Striped Mauritius, did very well yielding a heavy crop of high quality cane.

The highest yield of sucrose per acre in expressed juice was again returned by Striped Mauritius on plot 2a with over 9,800

lbs. sucrose per acre, followed by B-376 plot 3a with over 9,000 lbs.

Phosphate area.—The average increase in crop for all the ten varieties due to mineral phosphate amounts to 6,565 lbs. stripped cane per acre. Although this is within the limits of experimental error, the fact that four years ago when this area last carried cane, the average crop on the phosphate area was less by some 4,000 lbs. per acre than on the non-phosphate area, while this year the reverse is the case, is satisfactory evidence that, with lapse of time, raw mineral phosphate is coming into use. Moreover, the average yield on the phosphate area this year is some 12,000 lbs. per acre in excess of the yield on the same area in season 1911-15.

TABLE II.
Block F. Plant cane 1918-19. Varieties. (Non-phosphated area).
(Figures are per acre).

Variety.	Plot No.	Plot area.	Cane (lbs. per acre).	Juice (lbs. per acre).	Expression : juice on cane.	Sucrose in juice.	Invert sugar in juice.	Glucose ratio.	Purity co-efficient of juice.	Sucrose per cwt. of pressed juice.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12
1117	1	1.0	40,410	26,804	68.2	17.34	0.89	3.30	92.3	4,800	
"	11	"	40,400	25,940	64.1	17.39	0.83	2.95	94.5	4,867	
Stiffed Mauritius	2	"	66,920	45,450	67.9	18.20	0.43	2.30	94.8	8,277	
"	12	"	68,640	37,604	63.0	17.97	"	"	94.5	6,740	
11175	3	"	82,000	54,700	68.0	17.24	0.86	2.44	94.7	9,430	
"	13	"	71,800	44,200	61.4	17.66	0.48	2.72	93.0	7,760	
"	4	"	62,580	42,680	69.0	13.94	1.86	11.04	89.8	5,866	
SAFARI A	14	"	72,620	46,864	64.6	14.68	1.61	11.94	84.5	6,838	
"	5	"	11,760	27,140	65.0	18.81	0.36	1.73	93.6	5,105	
11120	15	"	28,140	31,350	63.7	18.97	0.44	2.96	93.7	4,305	

R-5412 ...	...	6	...	72,360	46,530	617	15-00	1-13	9-71	57-1	7,422
	...	16	...	76,130	51,021	605	14-00	1-13	9-00	57-3	7,402
Magh Sport	...	7	...	41,480	27,380	615	15-61	1-22	7-88	86-5	4,247
	...	17	...	64,180	39,400	617	15-27	1-17	9-02	86-9	6,016
J-38a	...	8	...	64,920	39,270	595	16-41	0-05	5-78	90-4	6,280
	...	18	...	86,990	38,850	580	16-16	0-91	5-55	89-3	6,284
Paradise E	...	9	...	53,200	33,810	630	14-47	1-51	10-47	85-8	4,897
	...	19	...	57,560	36,800	630	15-00	1-39	9-26	86-3	5,030
Magh	...	10	...	44,810	27,700	620	15-00	0-89	5-92	87-6	4,155
	...	20	...	46,000	used for planting		...	...	...	...	...
White Mauritius	...	21	...	76,800	47,370	610	18-60	0-57	8-00	93-7	8,830

TABLE III.

Block E. *Plant cane* 1918-19. *Varieties. (Phosphated area).*

Figures are per acre.

Variety.	Plot No.	Plot area.	Cane (lbs. per acre.)	Juice (lbs. per acre.)	Extraction juice on cane.	Sucrose in juice.	Invert sugar in juice.	Glucose ratio.	Purity co-efficient of juice.	Sucrose per acre in extracted juice.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12
B-147	1a	...	40,560	26,070	65.7	17.30	0.76	4.43	90.8	4,357	
	11a	...	40,500	26,010	64.3	...	...	...	...	...
Striped Mauritius	2a	...	84,570	54,330	64.3	18.47	0.47	2.61	93.6	9,317	
	12a	...	79,000	48,480	62.1	...	...	...	...	...
B-376	3a	...	87,540	56,580	64.5	17.00	0.64	3.76	92.3	9,618	
	13a	...	60,210	45,090	65.1	...	...	...	...	...
Barbados A...	4a	...	73,710	48,360	65.5	...	...	...	...	...
	15a	...	89,170	54,970	60.7	...	...	...	...	...

9. *Sugarcane planting experiment—Ratoon cane*—The plant cane results of this experiment appear in paragraph 9 of last year's report. The experiment provides for testing the value of wide and narrow trenches on the Java model, and also the different disposition of the setts in both cases. All trenches were 9 inches deep and 5 feet from centre to centre. In plots 1 to 4 they were 2 feet wide while in plots 5 and 6 they were only 1 foot wide. Eight thousand setts per acre were planted on all the plots. Cultivation and manuring was similar to that of the ratoons in the variety experiment. Other details are shown in Table IV together with the results.

As was the case with the plant cane last year the results are very close. Taking the two years together, however, while there would appear to be little or no advantage in having the trenches more than 1 foot wide, there thus seem to be some justification for planting the setts in a single row up the centre of the trenches rather than in two parallel rows. The difficulty of earthing the canes properly in the latter case probably accounts for this.

TABLE IV.
Block D. Ratoon cane 1918-19. Planting experiment.
(Figures are per acre.)

Variety.	Plot No.	Method of planting.	Plot area.	Cane (lbs. per acre.)	Juice (lbs. per acre.)	Expressed juice on cane.	Remarks.
1	2	3	4	5	6	7	8
Striped Mauritius.			Acres.	Lbs.	Lbs.	Per cent.	
	1	Java trenches 2 feet wide and 9 inches deep, 5 feet from centre to centre, setts 8,000 per acre planted in a single row up centre of trenches.	$\frac{1}{16}$...	62,160	38,635	62.1	
	2	Java trenches as in plot 1, but setts 8,000 per acre were disposed in the bottom of the trench in two parallel rows 12 inches apart.	$\frac{1}{16}$...	56,800	35,645	64.5	
	3	Duplicate of plot 1	$\frac{1}{16}$...	62,780	40,015	63.7	
	4	Duplicate of plot 2	$\frac{1}{16}$...	54,340	35,157	64.6	
	5	Java trenches 1 foot wide and 9 inches deep, 5 feet from centre to centre. Setts 8,000 per acre disposed in double parallel rows 6 inches apart.	$\frac{1}{16}$...	57,160	35,902	63.0	
	6	Java trenches as in plot 5, but setts disposed in a single row.	$\frac{1}{16}$...	52,000	32,955	63.3	

10. *New varieties of cane.*—As mentioned in paragraph 10 of last year's report a number of varieties were introduced early in 1918. These include three of Dr. Barber's seedling canes Co. 1, 6 and 9; three Java varieties J-36, 139 and 213; Ashy Mauritius, Mauritius 55, 90 and 131; D74; a purple Sport of Striped Mauritius from Kamrup; five varieties introduced into the Kamrup Farm by Mr. Maxwell; White and Red Bombai; Manjav from Manjri Farm, Poona; and seven varieties from the Surma Valley.

These were specially grown in the nursery in 1918, and several show much promise—notably Purple Mauritius, D74 and Co. 6 and 9.

Most of the above varieties are being grown on a field scale this year for observation and with a view to introduction in the variety experiment trials in 1920.

In March 1919 five additional new Java varieties were received direct from the Passeroen Sugar Experiment station, Java, and have been planted in the nursery.

11. *Soil investigations and manurial tests.*—The various experiments bearing on this work, most of which have reference to the treatment of sour soils, were continued. Now that the laboratory is completed and chemical work on the soil is possible it is hoped to modify and perhaps extend this work and place it on a better footing.

The work includes:—

Block G—Liming experiment commenced in 1909.

„ C—Liming and manurial experiment; also an experiment in the use of wood ashes, commenced 1911.

„ K—Experiments to ascertain the reasons underlying the beneficial effect of lime on the old red alluvium, and to test the action of various manures with and without lime, commenced 1912.

„ L—Ground limestone experiment, commenced 1913.

Blocks E, B, A & D—Experiments in the use of raw mineral phosphate in the sugarcane rotation initiated 1913, 1914, 1915 and 1916, respectively.

For previous details the reports for 1912 to 1918 may be consulted.

12. *Block G. Liming experiment.*—Half of this block was limed 10 years ago, and both sides have been regularly and similarly cropped since to see how long the effect of the single dressing of

lime will last. The cropping this year was cowpeas for green manure in the rains followed by matikalai, oats, gram and rape in the cold weather.

The cowpeas made a fair crop on the limed area, but a very poor one on the other.

The cold weather crops germinated well all over, but died off very early on the unlimed area. On the limed area the gram and rape died off later, while the oats and matikalai, although carrying through, produced practically no grain.

The effect of the lime clearly persists, but is gradually diminishing.

13. *Block C, Lime and Manurial Experiment.*—This experiment, designed to last in the first instance for 6 years, finished its initial course in 1917. By that time each of the limed sections had received a total of 2 tons of slaked lime per acre either (a) as one initial application, or (b) as two equal triennial dressings, or (c) in six equal annual dressings.

As regards cross dressings, each of the phosphate plots had a total of 1,440 lbs. bonemeal, *i.e.*, 240 lbs. annually, for 6 years. Each of the cowdung plots had been given a total of 48,000 lbs. cowdung, *i.e.*, 8,000 lbs. per annum for the 6 years.

It was considered desirable to continue this experiment for residual effect. In deciding on the lines of continuance it was considered that we should distinguish between—

- (A) manures used as soil treatment, *i.e.*, those used with a view more or less permanently to improve the soil for all cropping rather than supplying the immediate requirements of any particular crop. In this category we placed lime and bonemeal in view of the probability that the amount of either applied in the previous 6 years may be expected to influence cropping for some years to come, and also it is desirable to measure the residual effect of these two manures; and
- (B) other manures, *e.g.*, cowdung, which are more transient or whose effect on the soil is not of such a permanent character. In a hot and humid climate such as ours green-manures would also have to be placed in this category we think.

It was therefore decided—

- (a) to apply no more lime or bonemeal for the present;
- (b) to continue green-manuring one block once every four years;
- (c) to continue the annual cross-dressing of cowdung on sub-plots C and D.

The following rotation commencing from 1918 was decided on:—

—	Plots 1 to 4.		Plots 5 to 8.	
1	2		3	
	<i>Kharif.</i>	<i>Rabi.</i>	<i>Kharif.</i>	<i>Rabi.</i>
1st year (1918)...	} Jowar	Soybeans	} Jowar	Soybeans.
2nd „ (1919)...		Matikalai or Mustard.		Matikalai or Mustard.
3rd „ (1920)...	} Jowar	Soybeans	} Cowpea for green manure	Soybeans.
4th „ (1921)...		Oats		Oats.

Accordingly all plots were sown with soybeans in 1918, 100 maunds of co dung per acre having been previously applied to sections C and D.

Germination was good, the crop came away well and continued to do normally up to the end of September, but the heavy and continuous rain of August and September adversely affected it and thereafter all plots gradually became diseased. *Rizactonia* appearing in patches everywhere and gradually spreading. The more heavily manured plots were the first to go down with the disease. The crop had flowered and fruited all over the block, but subsequently it wilted and died out, so on the advice of the Imperial Mycologist, Pusa, it was burnt off. Therefore no cropping figures are available this year.

Some observations made previous to the attack are, however, interesting. (For plan of experiment see last year's report Table IV, page 18).

Lime dressing.

(a) *Non-green manured block.*—Plot 3 (triennial dressings) was best throughout followed closely by plot 2 (annual dressings) and then plot 4 (one initial large application). The non-limed area (plot 1) was carrying a yellowish looking stunted crop throughout.

(b) *Green manured block.*—Plot 6 (annual dressings) was best throughout, followed in order of merit by plot 7 (triennial dressings), plot 8 (one initial large application) and plot 5 (no lime).

The evidence such as it is, therefore, was again in favour of the lighter and more frequent dressings as against the large initial one in this, the 8th year of the experiment.

Cross dressings.—The cowdung showed up very strongly on this crop, and where applied (sections C and D) seemed largely to mask the effect of the phosphate, and also the lime dressings to a less extent. On sections A and B, however, which received no cowdung, there was a marked contrast between the lime and the non-limed plots, but in plots 2, 3, 4, 6, 7 and 8 the lime appeared to mask the action of the phosphate, the section cross dressed with bonemeal being little better than the corresponding section which received no cross dressing.

In plots 1 and 5, however, which received no lime, the section cross dressed with bonemeal was very much better than the section which received no cross dressing, and the section which was treated with bonemeal *plus* cowdung was a little better than that which received cowdung alone. Judging from this it appears that the bonemeal is still taking effect, but so far as this crop is concerned its action is very much less than that of lime and cowdung.

14. *Wood ashes experiment.*—In this experiment five plots received respectively 5, 10, nil, 15 and 20 maunds of wood ashes per acre per annum. Half of each plot is cross dressed annually with 100 maunds of cowdung per acre.

This is essentially a cultivator's experiment, and shows what can be done towards soil improvement on the old alluvium with wood ashes, especially if supplemented by cowdung.

From 1918 the same rotation as for Block C was adopted and Soybeans were sown, half of each plot receiving its annual dressing of cowdung before sowing. The crop suffered the same fate as that on Block C. Up to the time of the *Rhizactonia* attack the crop increased with increasing doses of ashes, the cowdung sections of the plots being better in each case.

15. *Block L. Ground limestone experiments.*—This was commenced in 1913 on very infertile newly broken up land. The scheme consists of 6 plots, each $\frac{1}{3}$ acre in area, in two series of 3 plots each. The first series, Section A, is cultivated shallow with country implements; while the other series, Section B, is being worked deeper with English implements. This ensures a deeper application of the limestone on section B than on section A, one of the chief objects of the experiment being to elucidate the effects of incorporating lime with the soil to varying depths, using a variety of cropping.

Ground limestone was applied as follows in 1913 :—

Sections A and B	{	Plot 1—15 maunds limestone per acre.
		„ 2—Nil.
		„ 3—30 maunds limestone per acre.

Further details of the scheme are given in previous years reports.

The cropping this year, the sixth of the experiment, was Dhaincha for green manure followed by oats. A dressing of 150 maunds per acre cowdung was applied previous to sowing the oats. The Dhaincha was sown very late owing to the previous Rahar crop being late in ripening, and consequently did not do really well on any plot.

Notes made on the appearance of the crop before ploughing in:—

Section A—Plot 3—Best crop, about 8 annas.

„ B— „ 3—Second best, about 5 to 6 annas.

„ A— „ 1—Third best, about 4 annas.

„ B— „ 1—Fourth best, very poor 2 annas.

Plots 2A and 2B (no lime) carried no crop at all.

The Dhaincha was ploughed in early in August 1918. The oats germinated well on all plots. The yields per acre (grain) were:—

—		Plot 1.	Plot 2.	Plot 3.
1		2	3	4
Section A (shallow)	... ..	lbs. 338	nil	lbs. 708
„ B (deep)	... ..	290	nil	750

Most of the seedlings died off early on the non-limed plots.

The results are difficult to explain in view of the fact that in previous years, with oats as the crop, section A has always done better than section B. This year section A leads only on plot 1, the increase here being probably outside the limits of experimental error, while section B plot 3 is better by 42 lbs. than section A plot 3, which is well within the limits of experimental error. However, these apparently conflicting results may have some significance. The full explanation will possibly be apparent only when the soils have been examined in the laboratory, but it is probable that in an abnormally dry season such as last cold weather, deeper cultivation would show more effect than in a normal season, and its greatest effect where other soil conditions were least objectionable. With a gradual return to acidity better conditions would be more likely to be met with in plot 3 than on plot 1, and the lime requirement of the surface soil of plot 1B is probably so much greater now than that of

plot 3B, that it masks every other influence. A factor, then, which might operate favourably in the case of plot 3B might be put quite out of court by the extra acidity in plot 1B. There is also other proof, from Block K, with increasing acidity, other factors become less and less operative for good, and this will probably prove to be the true explanation of this year's results.

16. Block K. Experiment to ascertain the early functions of Lime.—Commenced in 1912, this experiment was continued in its seventh year. For previous results reference may be made to Jorhat Farm reports for 1913 to 1918 and to Memoir No. 9, Volume III, Chemical Series of the Memoirs of the Department of Agriculture in India, entitled "Studies of an acid soil in Assam." The experiment is being carried on with a view to throwing further light on some aspects of the use of certain manures, both with and without lime on sour soils.

With lapse of time these plots are becoming increasingly instructive. Cropping was Cowpeas for green manure followed by oats. The results for the cowpea crop are of interest in regard to the continued use of certain artificials on green crops on this class of soil. Thus by far the smallest crop in the area was that of plot 11 which annually receives a dressing of sulphate of ammonia, which yielded only $\frac{1}{4}$ th of the outturn of the non-manure plot. Taking the yield of this sulphate of ammonia plot to be 100, the relative yields of some other plots were as follows:—

Plot No.	Manuring.	Relative yields of cowpea crop.	
		Without lime.	With lime.
11	Sulphate of Ammonia	100	1,365
20	Nitrogen as Nitrate of Soda ... ..	...	...
	Superphosphate ... ..	...	...
	Sulphate of Potash	1,810	2,176
21	Nitrogen as Sulphate of Ammonia ... ..	...	...
	Superphosphate ... ..	...	...
	Sulphate of Potash	500	1,783
22	Nitrogen as Nitrate of Soda ... ..	...	...
	Superphosphate	1,100	1,853
23	Nitrogen as Sulphate of Ammonia ... ..	...	...
	Superphosphate	290	1,001
24	Nitrogen as Nitrate of Soda ... ..	...	...
	Sulphate of Potash	890	1,082
25	Nitrogen as Sulphate of Ammonia ... ..	...	...
	Sulphate of Potash	100	1,088

Without any desire to lay stress on these figures, the plots being small it will be clear. I think that the use of Sulphate of Ammonia as a source of Nitrogen reduces the yield of the green crop as compared with the use of the same amount of Nitrogen as Nitrate of Soda; this applies even when lime is used, but more strikingly in the absence of lime. This deleterious effect is less marked where Superphosphate is applied along with the Sulphate of Ammonia. The figures would indicate also that, in the absence of lime, Sulphate of Potash and Superphosphate are less effective in manurial mixtures when the source of Nitrogen is Sulphate of Ammonia rather than Nitrate of Soda.

The results obtained in this experiment year after year do certainly emphasise the great value of lime and phosphoric acid (more particularly in its basic form) on this soil, and the markedly deleterious effect of Sulphate of Ammonia without lime in some form. The Sulphate of Ammonia plot is now almost, if not quite, sterile even to weeds.

17. *Plots E, B, A and D. Mineral phosphate experiments in the sugar cane rotation*—An area of about 1 acre in each of the four blocks in the cane rotation has been dressed with flour phosphate with a view to observing its effect on the various crops of the rotation. The phosphate is applied in the 4th year of the rotation previous to sowing the green crop of cowpeas. It will be repeated every fourth year at the same point in the rotation. The rotation is as follows:—Cane in the 1st and 2nd years; a green-crop of dhaincha followed by oats in the 3rd year; a green-crop of cowpeas followed by a catch crop of rape ploughed in in the fourth year.

It will naturally be some years before very much information will be available; at least we should work through two and preferably three complete rotations on each block before attempting to generalise.

The first rotation has now been completed on Blocks E, B and A. The results for E and B appeared in previous reports.

On Block A during the first and second years of the rotation there was an average increase in favour of the phosphate plot for the two crops of cane of $4\frac{1}{2}$ tons stripped cane per acre valued at Rs. 45.

In the third year of the rotation the yield of oats was almost identical on the phosphated and non-phosphated areas.

The total value of the increase is thus Rs. 45 per acre at a cost for phosphate of Rs. 15-12 leaving a net profit for the first four years of Rs. 29-4 per acre.

In paragraphs 7 and 8 of this report will be found an account of the effect of the phosphate on the ratoon and plant cane crops of the year under report.

Block B was the area to get phosphate this year; this is its second application, the first having been given in 1914. The following cowpea crop (rains 1918) did well all over; it was not weighed and it is difficult to judge differences in the field. The rape crop (*rabi* 1918-19) made a twelve-anna crop on the phosphated area, and 4 annas on the other. The rape was ploughed in in November 1918.

18. *Pulse crops*.—A number of pulse crops were sown on small plots with the object of testing their suitability for cultivation as food crops on similar land in the valley. Duplicate sowings were made, the first in September and the other in October. Sowing was done in lines two feet apart. The vegetative growth of the earlier sowings was much greater than that of the later sowings. In the results from 8 varieties sown, the earlier sowings did best in five cases, while the later sowings gave the better results in three. It is probable that still earlier sowing would give better results in some cases.

The outturns per acre as shown in the following table :—

Variety.	Date of sowing.	Outturn per acre.
		Lbs. seed.
1	2	3
1. Phaseolus Lunatus or Rangoon bean or Burma White Bean or "Pebyugale."	24th September 1918	946
	20th October 1918 ..	363
2. Phaseolus Calcaratus or the Rice bean or "Rumbaija" (Khasi Hills).	4th September 1918	437
	20th October 1918 ...	122
3. Kulthi Kalai or Dolichos biflorus...	24th September 1918	315
	20th October 1918 ...	nil.

Variety.	Date of sowing.	Onturn per acre.
		Lbs. seed.
1	2	3
4. Gram	{ 24th September 1918	123
	{ 20th October 1918 ...	219
5. Mung	{ 24th September 1918	88
	{ 20th October 1918 ...	44
6. Matikalai	{ 24th September 1918	560
	{ 20th October 1918 ...	35
7. Musuri	{ 3rd October 1918 ...	192
	{ 20th " " ...	298
8. Khesari	{ 3rd " " ...	735
	{ 20th " " ...	1,225

Some of these promise well. Further tests with special regard to time of sowing will be made next season, and it is proposed to sow the Rangoon bean, which is valued highly on the British market, on a field scale for trial.

19. *Fodder crops*.—In paragraph 20 of last year's report mention is made of the commencement of an experiment with Guinea grass, Rhodes grass and Kheri sugarcane for fodder.

Guinea grass was planted out from roots in June 1918. It gave four cuttings in 1918, *viz.*, in August, September, October and November. The drought then stopped its further growth, and the fifth cutting was not obtained until the end of March 1919 after rain. It thus gave practically no crop during the cold weather.

Rhodes grass was grown from seed, and was transplanted from the seed-bed early in August 1918. Small cuttings were obtained in September, October and November 1918, and increas-

ingly large ones in December 1918, February 1919, and again in March 1919. It appeared to stand the drought better than Guinea grass, giving three good cuttings between December 1918 and end of March 1919, as against one cutting of Guinea grass. The Rhodes grass is much finer and softer than Guinea grass, and is said to be more nutritious. Having been grown from seed it did not stand an equal chance with Guinea grass during the year under report, but judging from the results obtained up to date it would appear to be very promising as a cold weather fodder crop.

Kheri cane did fairly well, but is of little use as a fodder producer in the cold weather.

Both Guinea grass and Rhodes grass were planted out in clumps two feet apart each way.

Details of cuttings are given below :—

—	Date of planting.	Area of plot.	Outturn to November 1918.	Outturn to December 1918 to March 1919.	Total outturn per plot.
1	2	3	4	5	6
		Sq. ft.	Mds. srs.	Mds. srs.	Mds. srs.
Kheri cane ...	4th Apl. 1918 ..	5,285	43 5	3 6	46 11
Guinea grass ...	15th June 1918	3,600	41 2	10 14	51 16
Rhodes grass ...	8th Aug. 1918	3,240	5 28	25 22	31 10

The total outturns of green fodder work out at about 14.1 tons per acre for Kheri cane, 25.5 tons for Guinea grass and 14.2 tons for Rhodes grass.

The areas under Guinea grass and Rhodes grass will be extended during the coming season.

20. Extension area —

Block M—

Coppicing { Rains ... Dhaincha (green manure).
{ Rabi ... Oats.

Dhaincha made an uneven crop on the lined area, very patchy and irregular, varying from 2 to 12 annas within a few feet all over the block. This land will not be fit for accurate manurial experiments for years.

The Dhaincha on the un-limed area made no growth at all. Oats germinated well all over, but did no good on the un-limed area.

		Mds. srs.	
Outturn	Limed area ...	5	19 grain.
	Non-limed area ...	0	7 „

Blocks O, N & P.—

Blocks N and P were under ratoon cane for distribution.

Block O was half under plant cane for distribution, and the rest was under cowpea for green manure in the rains. In the Rabi season half the block was under Matikalai following cowpeas.

Area under Matikalai was 1½ acres.

Total outturn Matikalai was 6 maunds 32 seers.

Block R.—An experiment in the use of water Hyacinth ashes was commenced here in 1918. Two plots ½ acre each were laid out. To one plot Hyacinth ash at the rate of 20 maunds per acre was applied in May 1918. Both plots were cropped with cowpeas green manure in the rains. The cowpeas did much better from the start on the ashes plot.

Previous to sowing the rabi crop of the Khasi Matikalai, (*Phaseolus Calcaratus*, or the “Rice bean” also known in the Khasi Hills as “Rumbaija”) the northern halves of each plot, i.e., ¼ acre in each case, were cross dressed with 5 maunds per acre Basic Slag, of a very poor quality however.

		Mds. srs.	
Outturns were—	No manure at all ...	0	26 per acre.
	Basic Slag alone ...	2	0 „ „
	Basic Slag plus Hyacinth ashes ...	4	6 „ „
	Hyacinth ashes alone ...	4	13 „ „

Thus, while the Basic Slag had some effect alone, it did not increase the yield when added to Hyacinth ash. It is probable that the ashes functioned largely as a neutraliser of soil acidity, e.g., like our wood ashes. They contained some 8.94 per cent. Potash.

21. *Other crops.*—Block A was green manured with Dhaincha after two years cane. The crop was quite twice as big on the phosphate area.

In the Rabi season, Oats followed Dhaincha on part of Block A, yielding at the rate of 800 lbs. grain per acre. The rest of Block A was under mustards, English Yellow and Black

versus Local Yellow and Black. The English varieties germinated very badly and did no good at all. The local varieties did rather better but yielded very poorly. The drought went against them.

Cowpea for seed.—"Jorhat Brown" the farm selected variety, was sown in Block H, in August. The crop did fairly well and was harvested from mid November to end of January. Previous to sowing, the whole block was limed at the rate of 10 maunds slaked lime per acre; it also received 5 maunds rape cake per acre. The eastern part of the block was dressed with 5 maunds Egyptian Raw Phosphate per acre also. The crop was sown about a fortnight later than it would have been on account of very wet weather, and the long cold weather drought reduced the yield somewhat. The yields were 840 lbs. seed per acre from the phosphate and 800 lbs. seed per acre from the unphosphate areas.

Pota'oes.—Two plots of 1/20th acre in the kitchen garden; both had cowdung at 300 maunds per acre. One was also dressed with Hyacinth ashes at 10 maunds per acre.

Yields were	{ Hyacinth ash area 109 maunds per acre.
	{ Other area 75 " "

22. *Orchard.*—The fruit trees comprise 16 lichis, 6 mangoes, 1 custard apple, 3 sapota, 5 guava, 1 pomelo, 1 plum and 12 oranges. All fruited well except the mangoes. The young orange trees are not yet of bearing age but are making good growth. The only addition during the year was one peach tree. There are four varieties of pine-apples—Ceylon, Kew, Queen and Spanish; all fruited well and there was a large local demand for suckers.

23. *Receipts and expenditure.*—The receipts for the nine months ending March 31st 1919 were Rs. 1,472-7-9 while the total expenditure for the same period was Rs. 7,727-7-1 including Rs. 2,768-15-4 for establishment and Rs. 418-11 capital charges.

24. *Establishment.*—This consists of a Manager on Rs. 100—10—200, a clerk Rs. 25—1-8—46, and a peon on Rs. 8. Four apprentices finished their training during the period under report and were appointed demonstrators on probation in the districts. At the end of the year there were seven apprentices under training including one candidate for scholarship at the Sabour Agricultural College. Since then one of the two vacant posts has been filled, and the other is still vacant pending the selection of a suitable Mohammedan candidate.

25. *Inspection, etc.*—The Hon'ble the Chief Commissioner visited the farm in December 1918. The Director of Land

Records and Agriculture made several inspections, and the work of the farm was closely supervised by the Agricultural Chemist who is resident at Jorhat.

For practically the whole of the material for this report and also for much assistance in drafting it, I am indebted to Mr. A. A. Meggitt, Agricultural Chemist, Assam, who held charge of the farm during my long absence which lasted until nearly the end of the period under report.

A. G. BIRT,
Deputy Director of Agriculture,
Assam Valley.

REPORT OF THE UPPER SHILLONG AGRICULTURAL
EXPERIMENT STATION FOR NINE MONTHS ENDING
THE 31st MARCH 1919.

1. The Upper Shillong Agricultural Station was established in 1897-98. It is situated on the Cherrapunjee road, $5\frac{1}{2}$ miles from the town of Shillong, and occupies the site of the old Model Farm which ceased to exist in 1879. The elevation of the place is 5,900 feet, *i.e.*, about 900 feet higher than Shillong town. The total area of the farm is 366.67 acres, of which a large portion is occupied by pine forest. Most of the cultivated and culturable land lies in a long narrow valley. The bottom of the valley was formerly a marsh which was of very little value for any purpose; it has recently been converted into firm pasture ground by deepening the stream which drains the valley and opening side drains into it. The effect of this work is now showing in the considerably improved herbage which is produced.

The soil of the higher lands is a coarse reddish loam of very loose texture which can be worked with great ease. The subsoil is of a pronounced reddish colour and of great depth. In a small portion of the cultivated area the soil is black owing, it is believed, to the existence of some mineral compound. At the bottom of the valley a different type of soil is found, namely, clay or clayey loam, extremely rich in organic matter. Having long been under a thick growth of grass, the upper portion of this soil is a matted mass of half-decayed grass-roots.

In point of quality the soil of the farm is extremely poor and very little can be grown on it without the help of manure.

The greater part of the station suffers from the disadvantages of an exposed situation. The place is colder and more windy than Shillong; frosts are of very common occurrence and are more severe than in the town. During the winter the growth of vegetation is entirely suspended.

2. The main objects for which the station is maintained are the trial and introduction of new varieties of potatoes which are the most important among the crops grown on the plateau of the Khasi Hills, the breeding of improved strains of milch cattle suitable for this tract and the cultivation of fodder crops for their up-keep. Fodder experiments have been tried from time to time, but having proved abortive, they have one after another dropped

out of the programme of the farm. Very little experimental work beyond the potato trials is done at present on the farm, and if we leave out the cattle and the fodder crops grown for them, the station may be looked upon more as a seed-growing farm than one devoted to experimental work.

3. The following table gives the rainfall for the period under report :—

Rainfall.

				Actual, 1918-19.	Normal.	Number of rainy days, 1918-19.
1				2	3	4
1918.						
July	...	...	...	28.19	17.75	19
August	...	...	...	16.63	15.67	22
September	...	...	...	10.14	11.06	14
October	...	...	...	3.04	7.55	9
November	...	...	...	0.00	1.27	...
December	...	...	...	0.00	0.18	...
Total for six months				58.00	53.48	64
1919.						
January	...	...	...	0.80	0.29	2
February	...	...	...	0.07	1.02	...
March	...	...	...	0.40	2.25	2
Total for three months				1.27	3.56	4
Total for nine months				59.27	57.04	68

The autumn rainfall being rather less than usual was suitable for hay-making and harvesting of the principal crops. Early frosts stopped the growth of winter potatoes and the crop was a total failure.

A severe drought in spring checked germination of the potato sets and a period of heavy rainfall in May and June produced conditions favourable to potato disease, with the result that this year's outturn was smaller than even the last year's crop.

The other crops gave a smaller outturn than usual. The upland rice was poor, maize, raishan, and Job's tears crops were moderate. Owing to the extremely heavy downpour of rain in May and June not only were the crops injured on some of the steep hill sides, but considerable damage was done by surface soil being washed away.

Summary of work. 4. The work done during the year included :—

- (1) Trials of different varieties of potatoes.
- (2) Growing potatoes for seed.
- (3) Trials of new crops.
- (4) Fodder crops.
- (5) Cattle breeding.
- (6) Distribution of seeds, implements, etc.

5. The total number under this experiment in 1918 was 23 varieties. Where it was possible each variety was planted in duplicate plots of $\frac{1}{16}$ th acre each. All the varieties were planted in March and harvested in August, and winter seed was used in each case. The land was manured with 11 tons cowdung and 823 pounds of rape cake per acre, and the crop was sprayed with Bordeaux mixture at the rate of 240 gallons per acre applied in two equal doses.

The outturns of each variety in 1918 and in previous years are exhibited in the following table :—

Statement showing the average yield per acre on duplicate plots for the last eleven years.

Variety.	1918.	1917.	1916.	1915.	1914.	1913.	1912.	1911.	1910.	1909.	1908.	Average of last eleven years.	Remarks.
	2	3	4	5	6	7	8	9	10	11	12	13	14
1. King of Potatoes ..	5.94	4.07	9.20	6.33	6.0	6.84	6.56	7.37	4.83	3.51	11.7	7.12	
2. Magnum Bonum (1903) ..	4.51	5.23	9.23	6.77	7.35	6.07	8.51	5.90	4.83	3.22	10.18	6.88	
3. King Edward VII ..	2.75	3.65	7.35	4.61	6.17	4.90	4.53	6.0	2.68	3.81	9.67	4.84	
4. Khasi Nainital ..	3.64	4.12	3.71	5.43	6.03	6.39	6.11	5.73	4.35	4.10	10.7	5.90	
5. Khasi Round ..	2.17	2.89	5.80	4.93	4.53	4.51	4.09	4.65	3.40	3.76	9.35	4.16	
6. British Queen (1903) ..	3.32	4.75	9.12	7.36	7.19	5.90	6.65	6.06	3.40	...	...	6.28	
7. Up-to-Date ..	4.94	4.61	9.75	6.12	7.62	6.84	6.53	5.61	3.30	...	...	6.63	
8. Magnum Bonum (1912) ..	3.33	4.55	6.91	4.93	6.24	5.72	6.22	...	...	...	...	6.04	
9. Windsor Castle (..)	4.27	6.49	10.12	6.20	6.75	4.73	7.19	...	...	...	...	6.63	

The same 23 varieties are under experiment in the present year. As in former years, 50 tubers of each variety were selected at random, cut open, and examined for signs of disease. The following table gives the result of the examination in the last eight years :—

Varieties.	Number of diseased tubers out of 50 examined.									
	1910.	1911.	1912.	1913.	1914.	1915.	1916.	1917.	1918.	
1	2	3	4	5	6	7	8	9	10	
King of Potatoes	13	nil.	nil.	nil.	1	5	3	nil.	2	
Magnum Bonum (1903)	6	4	2	4	2	nil.	1	nil.	4	
King Edward VII (1906)...	18	8	4	6	5	4	1	nil	1	
Khasi Nainital (1909)	48	16	6	4	4	8	nil.	1	6	
Khasi Round (1909)	4	8	6	10	8	6	10	3	7	
British Queen (1909)	13	...	6	4	2	8	2	nil.	1	
Up-to-Date (1909)	4	32	16	4	1	6	4	1	nil.	
Magnum Bonum (1912) ... ..	...	...	6	6	2	2	1	5	3
Windsor Castle (1912) ... ..	...	...	4	3	2	10	1	nil.	nil.
British Queen (1912) ... ..	...	...	4	4	3	6	1	3	3
Flour Ball (1912) ... ..	...	...	6	3	1	10	1	1	nil.
Imperator (1912) ... ..	...	...	22	3	3	4	6	nil.	2
Stirling Castle (1915) ... ..	...	...	...	...	...	...	10	nil.	5
Epioure (1915) ... ..	...	...	...	...	...	...	5	1	6
Magnum Bonum (1915) ... ..	...	...	...	...	...	...	5	nil.	3
Dover Castle (1915) ... ..	...	...	...	...	...	...	4	1	4
Up-to-Date (1915) ... ..	...	...	...	...	...	...	1	1	4
King of Potatoes (1916)...	...	...	...	...	...	...	...	nil.	nil.
Windsor Castle (1916) ... ..	...	...	...	...	...	...	2	3	1
Edinburgh Castle (1916) ...	...	...	...	...	...	...	3	nil.	nil.
Acquisition ... ..	...	...	...	...	...	...	...	3	nil.
Balmoral Castle ... ..	...	...	...	...	...	...	5	3	2
Arran Chief ... ..	...	...	...	...	...	...	...	2	3

Potato disease caused by *Phytophthora Infestans* is often responsible for considerable damage to the potato crop in the Khasi Hills. This year the damage to the farm crop was greater than usual, owing to growth being delayed by an early drought, which was followed by rather heavy rainfall in May and June, and an

early appearance of potato blight. Preventive spraying is a thoroughly and systematically carried out on the farm every year as weather conditions permit.

In the present year part of the crop was sprayed twice with Bordeaux mixture, at 120 gallons per acre each time, the balance being sprayed once at the same rate.

Notwithstanding this treatment, growth ceased early and the crop is even smaller than in the previous year.

During the year under report three new varieties were obtained from England, viz., Arran Chief, Edinburgh Castle and Stirling Castle.

Twenty lots of seed were obtained in February 1916 from St. Andrew's University, through the kindness of Donald Ferguson, Esq., of Dhamai Tea Estate, Sylhet, Honorary Correspondent of the Department. Half of each lot of seed was sown in boxes on 20th February 1916, and the remaining half was sown similarly on the 19th March 1916. Out of twenty lots, numbers four and twenty failed to germinate. The others grew satisfactorily, and the seedlings were planted in the field on the 15th May 1916.

Two lots of seed produced only one plant each, and as one of these plants failed to form any tubers, the total number was reduced to seventeen. Two lots were destroyed by insects and the remaining seventeen have given widely varying yields in the past two seasons. Calculating the yields to a uniform amount of one seer of seed of each variety, the outturn has varied from 4 to 56 seers. These varieties are being grown on a larger scale in the present year and it is probable that several good varieties will be found among them.

Potato manūrial experiment.—An experiment designed to shed some light on the respective manūrial values of rape cake and bonemeal for the potato crop was carried out in 1916 and 1917 and repeated in the present year. This experiment was put down in duplicate on a series of plots of King of Potatoes, and a similar duplicate experiment was carried out with

Magnum Bonum. The seed rate was 987 pounds per acre. The manures used and the yields obtained per acre in 1918 are shown in the accompanying table :—

1	2	3	4	5	6	7
Manures used per acre.	Cowdung. 5·5 tons.	Cowdung 5·5 tons, rape cake 323 pounds.	Rape cake 323 pounds.	Bonemeal 323 pounds	Cowdung 5·5 tons, bonemeal 323 pounds.	Rape cake 323 pounds, bonemeal 323 pounds.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
King of Potatoes	1·89	1·93	·83	1·87	3·83	2·36
Magnum Bonum	1·91	2·78	·68	1·55	3·10	2·56
Total	3·80	4·71	1·51	3·42	6·93	4·92
Average yield per acre	1·90	2·35	·77	1·70	3·46	2·46

Bonemeal and rape cake were used not because they were considered the most suitable for the potato crop, but because they are practically the only manures, other than cowdung, which are known to the cultivators of the Khasi Hills.

From the yield obtained it would seem that bonemeal is more effective than rape cake both when used as a supplementary dressing with cowdung and when used alone. These manures are again under experiment in the present season.

6. It is the custom among Khasi cultivators to grow an autumn crop of potatoes, principally for the purpose of using the produce for seed for the following spring crop. This custom has been followed at the farm for some years but, owing to the exposed situation of the farm, it has been found that the yield of the autumn grown crop is so small as to make seed produced in this way extremely expensive. With the object of finding a cheaper source of seed, the method of boxing summer sets was tried. The method consists of placing the seed potatoes in shallow boxes specially made for the purpose, and of storing them in a

Sprouting seed
potatoes.

well-lighted but not too airy shed. Under conditions of moderate temperature and moisture the sets keep satisfactorily and produce short, well formed sprouts which grow at a slow rate. These sets can be planted out from the boxes at the ordinary planting season and are then likely to grow rapidly.

During the past season this method was carried out in the following manner. Potatoes from the summer crop of 1917, valued at Rs. 2-8-0 per maund, were placed in sprouting boxes and kept there during the cold weather 1917-18. In the spring of 1918 these sprouted summer sets were planted alongside unsprouted winter sets valued at Rs. 5 per maund. The size of sets and weights used per acre were approximately the same. Similar conditions of cultivation, manuring and spraying were observed for both lots, and as the experiment was tried with six of the main crop varieties, the results may be taken as fairly conclusive.

The average of the yields obtained from unsprouted winter seed was 4.41 tons per acre, while the average obtained from sprouted summer seeds was 4.45 tons. This is a satisfactory result, and if confirmed in future years would be capable of profitable expansion both on the farm and on areas outside of it.

7. Six varieties of potatoes were grown during 1918 for the production of seed. These varieties were King of Potatoes, Magnum Bonum, Up-to-Date, Windsor Castle, British Queen and Imperator. The crop was planted in March and harvested in August. The total area planted was 7.04 acres as against 7.4 acres in 1917. The manures used were, as in previous years, 5.5 tons of cowdung, and 823 pounds of rape cake per acre. The crop was sprayed once with Bordeaux mixture at the rate of 120 gallons per acre. The outturn was as follows:—

Variety.				Area, in acres.	Total yield, in tons.
1				2	3
King of Potatoes	...	...	...	2.20	6.46
Magnum Bonum	...	...	...	1.62	2.25
Up-to-Date	...	...	...	.87	.59
Windsor Castle	...	...	...	1.00	2.24
British Queen (1909)	...	...	...	.4	.72
Imperator	...	...	...	.95	2.61
Total,	...	...	...	7.04	14.87

The average yield per acre amounted to a little over 2·11 tons against 3·2 tons in 1917.

For the present year about 5 acres have been planted in March with the same 6 varieties. The demand from the plains for seed potatoes grown on the Shillong Farm is extending rapidly. In order to meet this increased demand, the area under this crop has been extended as far as practicable with the quantity of cattle manure which is available. Even then there is an insufficient supply for the requirements of both hills and plains districts. To still further increase the supply, arrangements were made in 1917 to cultivate an extra area of potatoes under the *Jhum* system and this has been continued since. In that year an area of $16\frac{1}{2}$ acres was planted on the farm lands according to this system in 1917 $10\frac{1}{2}$, in 1918 $10\frac{1}{10}$ acres, and in the current year about 6 acres have been so planted.

An agreement was made with Khasi cultivators to carry out this work. The terms were that the farm should provide the land and the seed, and the cultivators should do the work and return to the farm one and a half times the seed supplied. The cultivators also undertake to sell, at bazar rates, whatever additional quantity of seed may be required. In 1918, the farm supplied for this purpose 3·78 tons and in return received 6·91 tons. This included 1·23 tons received as payment for the work of spraying the crop with Bordeaux mixture, which was done by the farm workers.

In the present year 6 acres are being cultivated under a similar agreement. The farm supplied 1·76 tons and it is expected that the return will be about 2·83 tons. With the object of increasing the supply of seed potatoes suitable for distribution in the plains, a scheme has been started by which Khasi cultivators undertake to grow on their own lands, seed potatoes supplied by the farm. The seeds are supplied free on the cultivator entering into an agreement to keep the crop pure and to return to the Department, from his crop, one and a half maunds for each maund supplied free. One hundred and fifty maunds have been distributed on these terms for the present planting season. The total quantity of potatoes available for disposal last year (1918) was 26·59 tons made up as follows :—

			Tons.
Farm grown crop taking summer and winter crops together			19·49
Seed returned by the <i>jhum</i> growers	...	...	6·91
Purchased from <i>jhum</i> cultivators	...	...	·19
			<hr/>
Total	...	...	26·59
			<hr/>

This quantity was disposed of as follows :—

	Tons.
Sold to Khasi cultivators \	6.8
Supplied to Gauhati Seed Depôt and other places in the province through the Agricultural Officers ...	5.00
Sold direct from the farm to officials and private individuals outside the Khasi Hills ... ..	.22
<hr/>	
Total quantity supplied for seed	12.02
Used on the farm and <i>jhum</i> area for planting	9.08
Dryage and rottage and feed of cattle	5.49
<hr/>	
Total	26.59
<hr/>	

The price charged to Khasi cultivators for seed potatoes supplied was the market price for table potatoes for the time being which was about 2-8-0 per maund.

Damaged potatoes and potatoes which were unsuitable for seed were fed to the farm stock

The seed potatoes sold consisted of 4.45 tons of King of Potatoes, 2.18 tons of Magnum Bonum, 1.53 tons of Up-to-Date, 2.85 tons of Windsor Castle, .55 tons of Imperator, and .46 tons of British Queen.

8. Experiments on the warping of rice land have been carried out on wet rice land for the past few years. As the results were unsatisfactory the experiments have been discontinued. During the year the land was utilized for trials of lime and bonemeal on wet rice.

The following two series have been laid down :—

First series, Lime experiment.—Duplicate plots of $\frac{1}{10}$ th acre each have been manured with lime at the rates of 10 maunds, 20 maunds and 30 maunds per acre, respectively, and four plots remained unmanured as control. All the resulting crops were very poor; only the heavily limed plot showed some slight improvement.

Second series, Lime versus Bonemeal.—Duplicate plots of $\frac{1}{10}$ th acre each have been manured with bonemeal at 3 maunds per acre and another series of duplicate plots with lime at 30 maunds per acre. The rest remain as control plots. The results were $6\frac{1}{10}$ maunds from bonemeal, $1\frac{3}{8}$ maunds from lime and 2 maunds from the unmanured plots

For both experiments, the seed was sown early in May at the rate of 40 seers per acre. When the seed was about to germinate heavy rainfall set in and consequently the germination was uneven and the results unsatisfactory.

Naga Hills rice.—Two varieties of rice from the Naga Hills, *viz.*, Rhelaw and Thavier, were tried at the farm in the past season. These were sown at about the same time as the above on land of $\frac{1}{4}$ acre. Germination was satisfactory but the crop flowered so late that it had not time to mature before frosts came.

9. *Buckwheat.*—This crop has been recently introduced into the district by Nepalese settlers, and although the returns have not been very large, it seems to have possibilities on the Khasi Hills, as the cost of cultivation is so small. When the seed is sown immediately after the potato crop is dug, no extra cultivation is required. On the farm this course was followed satisfactorily for the first two years of the experiment. In subsequent years the crop has been disappointing owing to early frosts. In July 1918 one acre of potato land was sown but owing to early stoppage of growth the result was that only 1 maund 6 seers of seed was gathered. The outturn would have been much greater if the crop had ripened properly.

Rhubarb.—This crop was first planted in 1912, on a plot of land about $\frac{1}{10}$ th of an acre in extent. Two additional plots have been planted since— $\frac{1}{20}$ th acre in 1915, and $\frac{1}{3}$ acre in 1918. The land was manured with cowdung at the rate of 11 and lime 33 tons per acre. During the month of July 1918 about 46 lbs. of stalks were sold realizing Rs. 5-12-0. A total of Rs. 60-12-0 was realized in the season from $\frac{1}{10}$ acre but Rs. 55 of this was received in the previous financial year. The plants are growing well.

Strawberries.—In September 1916 an additional plot of $\frac{1}{20}$ th acre was planted with two varieties of strawberries obtained from the Fruit Experiment Station, Shillong. These plants grew well and in October 1917 another $\frac{1}{10}$ th of an acre was planted with the suckers of these two varieties. The plot planted in 1912 is $\frac{1}{10}$ th acre. The total area at present is about $\frac{1}{10}$ th acre.

All the plots were manured last winter with cowdung and bonemeal at the rate of 11 tons and 247 pounds, respectively. The strawberry plants are growing well but, owing to the severe spring drought, they flowered late in the season and most of the fruits were destroyed by heavy rains in May.

Only about 8 pounds of fruits have been picked and sold during the year, and the return therefrom was Rs. 5-12.

Other fruits.—A few of the trees on the farm bore fruits. These were sold and realised the following sums :—

				Rs.	a.	p.
Apples	...	...	...	4	1	0
Peaches	...	...	...	1	7	0
Chestnuts	...	...	...	4	2	0
Plums	...	...	...	0	5	0

10. The following fodder crops were grown during the year :—

Names of crops.			Area sown.	Cost of cultivation.			Outturn of green fodder.
1			2	3			4
			Acres.	Rs. a. p.			Tons
Maize ...	...	...	13.6	455	8	8	25.72
Job's tears	...	...	13.27	359	12	5	10.89
<i>Jhum</i> area	...	...	5 App ^{rox}.	...			6.69
Total ...	...	...	31.87	795	5	1	42.71

The maize crop gave a very poor yield. Job's tears did well on the *jhum* area, but the farm crop was poor.

The whole of this fodder (42.71 tons) was made into ensilage. From this quantity of green material 35.33 tons or 82 per cent. was recovered as ensilage of good quality.

The total cost of silage was Rs. 962-12-9, made up of cost of cultivation Rs. 795-5-1, cost of carrying the fodder, chopping, and packing in the silo Rs. 167-7-8.

The proportion of loss through decay around the sides of the pit in which the ensilage was made, was somewhat similar to that of the previous year. The cost per ton of silage was Rs. 25-10-0 as compared with Rs. 19-9-0 in the previous year.

Raishan (*Paspalum Sanguinale*)—has been successfully grown as a hay crop since 1912 and has proved a valuable winter food for the cattle. *Raishan* was grown on an area of 13.27 acres and the produce was made into hay and fed to the cattle

during the winter months. In addition to Raishan, about 1.9 acres of soybean and .65 acres of hill paddy were grown and the product mixed with the hay.

A total amount of 14.95 tons of hay was fed during the year. The cost was Rs. 436-0-5 or a little over Rs. 28-14-0 per ton of hay as compared with Rs. 32-4-0 in 1918.

The quality of this fodder was good, and all was eaten by the cattle.

Cattle breeding. 11. The following table shows the number of cattle in the herd on 31st March 1919 :—

Descriptions.	Montgomery.	Montgomery x Ayrshire.	Montgomery x Patna.	Montgomery x Patna x Bhutia.	M x P x B x P.	M x P x B x P x P.	M x Bhutia.	Patna.	Bhutia (B).	P x B.	P x B x P.	P x B x P x P.	P x B x P x P x P.	P x Khadia (K).	Total on 31st March 1919.	Total on 30th June 1918.	Total on 30th June 1917.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Breeding bulls ...	1	...	...	...	...	...	...	1	...	...	...	...	...	...	2	1	1	
Bulls (3 years and above),	1	1	...	...	...	...	...	1	...	...	3	2	...	2	10	6	3	Are being used as plough.
Bulls (2 to 3 years) ...	...	...	...	...	...	...	...	4	...	...	...	1	...	...	5	9	7	
" (1 to 2 years) ...	...	...	1	1	1	2	...	3	...	...	...	...	...	...	8	6	8	
" (under 1 year) ...	...	...	3	1	1	...	...	...	...	...	...	...	...	...	5	10	6	
Heifers (2 to 3 years)	...	...	...	...	...	...	...	3	...	1	1	...	...	...	5	10	10	
" (above 3 years)	...	...	...	...	...	...	...	6	...	1	2	...	...	...	9	5	1	
" (1 to 2 years) ..	...	...	1	1	3	...	1	2	...	...	3	1	1	...	12	7	12	
" (under 1 year)	...	...	5	2	4	...	1	...	...	...	...	...	...	...	12	14	9	
Cows ...	...	...	...	...	...	...	...	12	1	5	9	3	...	...	30	32	20	
Total on 31st March 1919.	2	1	10	5	9	2	2	32	1	7	17	7	1	2	98	...	...
Total on 30th June 1918.	2	1	4	4	3	4	1	30	1	6	14	14	3	2	...	100	...	
Total on 30th June 1917.	1	...	...	...	...	...	...	40	1	9	13	15	4	2	...	...	66	

In addition to the above, there were at the end of the period two Hindustani, 8 Khasi and 2 Manipuri bullocks. The total number of cattle was therefore 110 against 111 on the 30th June 1918.

Two young bulls, of the Taylor breed from Patna, of 4 and 2 years old, respectively, were purchased for breeding purposes from Sonepur fair and the two Manipuri bullocks above mentioned were obtained from Karimganj farm during the year.

The total yield of milk during the period under report amounted to 1,983 gallons, out of which about 105 gallons were fed to calves and the remainder was sold at the rate of 14 lbs. for a rupee from June to 31st December 1918, and at 13 lbs. for a rupee from 1st January to 31st March 1919.

The cost of maintenance of the herd amounted to Rs. 4,903-0-11. The income from the sale of milk amounted to Rs. 1,407-11-10 and the value of the cattle sold to Rs. 753.

The half English Patna cattle and the progeny of their cross with Khasi and Bhutia breeds have proved remarkably well adapted to the climate of the Khasi Hills. In respect of milking capacity these cattle stand head and shoulders above any cattle on this side of India.

The demand for these cattle continues keen, but is still practically confined to tea planters and a few people about Shillong who are experienced in the care of cattle. As the herd was becoming somewhat large for the grazing and other food resources of the farm, and the cost of purchasing food in large quantity prohibitive, it was considered advisable to sell off a few of the older and poorer stock, to allow of expenditure being kept within reasonable limits. It is probable that a further number will be sold off before next cold weather as the stock is still too large.

The breeding bulls are generally in demand as fast as they reach the three years of age at which they are considered fit for disposal, but at the present time there are a few bulls on hand owing to some orders having recently been withdrawn.

During the period under report one bull was sold to the Political Officer at Sadiya, three to tea planters of the province, two were sent to Karimganj in exchange for two bullocks received from the farm there, and fifteen of the poorer cattle of various ages and condition were sold by public auction at Shillong.

The cost of maintaining the herd is becoming higher owing to the rise in prices of all food stuffs. It might be possible to reduce the expenditure by separating the cows from the rest of the herd and maintaining them purely with a view to profit.

The present herd of Patna cattle is far superior to the cattle of the province, and it would undoubtedly be advisable to maintain this breed if that were possible. Ineffective attempts were made to obtain young bulls from the Patna district in recent years; however during the year under report, two young Patna bulls of the desired type were purchased at Sonepur fair and arrangements are being made to keep the original Patna strain as pure as possible.

During the month of August 1918 there was a serious outbreak of foot-and-mouth disease among the farm herd. The Veterinary Assistant attended regularly at the farm during this time and, largely owing to the care and attention given by him, our losses were restricted to two newly born calves.

12. The following were the seeds and plants supplied to agriculturists during the year :—

Distribution of seed and plants.

			Tons.	Number.
Seed potatoes	...	...	12.32	...
Rhubarb roots	...	...	...	32
Pear grafts	...	...	...	12
* Oilcake for manure	...	...	2.20	...

* This was not sold direct from the farm but was recommended and procured for the cultivators.

13. U Herrick Singh continued in the position of Farm Manager during the year. He took privilege leave for two months and U L. Harry Singh acted during his absence. U Shetro Mohan Jyrwa continued in the position of Farm Clerk.

Two apprentices, Glosion Singh and Sedro Singh, completed their two years' course of Practical Training. U Owelmoni and U Melancton have since been appointed apprentices. In addition to these apprentices one Khasi and one Garo candidate apprentice are being entertained. These young men work with the labourers and are paid at the ordinary rates.

A Lushai Demonstrator has recently been deputed for further training at the farm, and is now working with the other apprentices.

14. The total receipts, including the value of seed potatoes used for demonstration purposes in the province, were Rs. 3,011-0-10.

The sale of milk produced Rs. 1,407-11-10, the sale of cattle Rs. 750, while potatoes sold direct from the farm realised Rs. 468-15-0, and in addition, potatoes to the value of Rs. 340-13-0 were supplied for demonstration purposes throughout the province.

The total expenditure for the period under report amounted to Rs. 13,357-12-1 against Rs. 14,455-10-11 in the previous twelve months. The details are as follows :—

			Rs.	a.	p.
Establishment	...	...	1,884	5	2
Petty construction	...	...	1,514	12	2
Feed of cattle	...	...	3,948	8	2
Seed, plants and manures	...	...	486	13	3
Wages of farm labourers	...	...	3,300	7	3
Petty repairs	...	...	1,144	5	2
Purchase and repair of furniture	...	...	88	2	6
Service postage and telegrams	...	...	30	0	0
Unspecified charges	...	...	454	5	9
Purchase of cattle	...	...	807	6	9
Reclamation	...	...	198	9	5
Total	...	...	13,357	12	1

The expenditure was heavy owing to the high prices of food stuffs, manures, etc., and also to the fact that a new area of about 16 acres has been permanently reclaimed. A sum of Rs. 1,514-12-2 was spent on erecting a permanent wire fence and a new cattle food godown.

CAMP SILCHAR,
The 29th April 1913.

J. W. MCKAY,
Deputy Director of Agriculture, Assam.

REPORT OF THE FRUIT EXPERIMENT STATION,
SHILLONG, FOR NINE MONTHS ENDING THE 31st
MARCH 1919.

1. *Introductory*.—The Fruit Station commenced work in October 1912: planting was commenced in the spring of 1913. The land is situated on the south side of the Jowai road, distant about a mile from Shillong. The elevation is about 5,100 feet. The total area is 62 acres, of which about 30 acres is suitable for fruit growing: 28½ acres have been planted.

2. *Lower Garden*.—No extension to this block has been made since 1913-14. The planted area is 4½ acres in grounds of 6½ acres: the fruit trees are planted 15'×15' diagonally. The soil of this block varies from light sandy loam lying above stone to heavier loam of good depth. The following varieties on the heavier loam continue to improve in growth and yield—James Grieve, Kerry Pippin, Rymer, Bismarck, Peasgood's Nonsuch, Devonshire Quarrenden, Crimson Bramley, Bramley's Seedling, Lane's Prince Albert. The following varieties yielded sparsely:—Red Juneating, Mr. Gladstone, Warner's King, Scarlet Nonpareil, Alfriston, Yellow Ingestre. Of the others Ribston Pippin, Cox's Orange Pippin, Hounslow Wonder, Hector MacDonald, Cox's Golden Drop, Golden Reinette bore a few fruit; and Mannington Pearmain, Barnack Beauty, Coronation, Wealthy, Roundway Magnum Bonum, Fearn's Pippin, Rosemary Russet, Newton Pippin, did not bear fruit. On the lighter soil only the stronger growing varieties have succeeded, *viz.*—Encore, Bramley's Seedling, Crimson Bramley, Newton Wonder, Lady Sudely, Norfolk Beauty, Potts Seedling, Peasgood's Nonsuch, Alfriston, Lane's Prince Albert, Alington Pippin, Red Victoria, Kerry Pippin, Rymer. Of the varieties planted in place of ones of weaker growth that failed, Rev. W. Wilks, Worcester Pearmain, Bismarck, William Crump, Syke House Russet, Ardeairn Russet, Upton Pyne, Bens Red, promise best: the other varieties planted last year, *viz.*, Grenadier, Star of Devon, Charles Eyre, Lord Derby, did not bear fruit.

The Pear trees suffered from the drought in March and April and put on very little new growth. Of the Bush trees Fertility, St. Swithin, and Fondante Thirriot bore good crops for the size and age of the trees. As far as can be now judged, Fertility is a great bearer and should be useful for market: St. Swithin

an early variety, is a prolific bearer, but is small and a poor keeper: Fondante Thirriot is a large white-fleshed pear that promises well for market. Madame Treyve, Durondeau, Beurre d' Amanlis, Emile d' Heyst, bore fruit for the first time.

The following Espalier trained trees bore well:—Fondante d' Automne, medium size, flesh very tender and deliciously sweet: Marguerite Marillat—very large, uneven in outline, which did not ripen well this year, William bon Chretien—large melting and of strong musky flavour. [This well known fruit, whose name is freely adopted for any pear, was raised by a school master named Stair of Aldermaston about 1770. In that county it is still called "Stair's Pear",—it took its name "Williams" from its distributor a nurseryman of Turnham Green. On its introduction to America it was again renamed after its importer Mr. Bartlett.] Louise Bonne of Jersey—medium size, a delicious melting white-fleshed pear.

The Cherry trees suffered badly from the drought, and flowering late only a few set on the "Kentish" trees. The "Peregrine" was the only variety of the Peaches that ripened well: first class fruit was picked from the trees from 17th June to 5th July. The "Kestrel" trees bore a good crop, but incessant rain from the 7th to 15th July spoilt them as they were ripening. The 2 Exquisite Peach trees bore well for the first time, the fruit ripening at the end of July. The fruit is yellow-fleshed freestone of poor quality compared to the earlier varieties. The other varieties flowered late owing to the drought, and yielded only a few undersized fruits.

The 3 varieties of Plum trees left in this garden for further experiment on light soil, *viz.*, Deniston's Superb Gage, Belle de Louvain, Belgian Purple, bore only a few fruit. One of the Langley Bullace trees bore a big crop of dark purple culinary fruit. This variety was raised by Messrs. Veitch (Farleigh Damson X Early Orleans Plum) and introduced in 1902. It is evidently, as described by the raisers, of great fertility and promises to succeed in this climate. The "Merryweather's Damson" trees bore well and the fruit is all the raisers—Messrs. Merryweather and Sons, claim for it; it could readily be mistaken for a late plum until tasted: although the size is so much above that of the largest Damson grown, the true flavour of the Damson is retained. The Giant Himalaya Berry of California and the Blowers are the best of the varieties of Blackberries and the King's Acre Berry, the best of the Hybrid Berries. None of the fruit came to perfection owing to the excessive rain in July, when they were ripening. The Raspberries showed no improvement and have been discarded. White la Versailles White Currants fruited

and further trials will be made with this variety. The Black Currants transplanted to shady sites have put on good growth but have not fruited. The land has been kept in good cultivation during the year. The lighter soil was again found to be infested with cockchafer grubs necessitating removing the soil round the trees to destroy them. A great many were also killed when the garden was deep hoed. During May and June the cockchafer beetles were caught in thousands by lamp light after dark. Calyx spraying with Arsenate of Lead solution was done, but this may not be the remedy for the grub in the Apple, which Mr. T. Bainbrigge Fletcher, Imperial Entomologist, Pusa, has discovered is the larva of a weevil, an insect that eats small patches in the fruit and oviposit in excavations along the edges of such patches. The control of this pest is of the greatest importance in an Apple Orchard. There is also a brown weevil that attacks apple shoots. A large blackish weevil, is very destructive to Fig trees and although grubs are destroyed as noticed, the damage done eventually kills the tree. There are a great many sucking insects that do damage which will be difficult to control when the trees grow bigger : at present they are caught by hand and destroyed.

3. *Upper Garden*.—The area planted is $24\frac{1}{2}$ acres, of which $10\frac{1}{2}$ acres was planted in 1914, 2 acres in 1915, $\frac{1}{2}$ an acre in 1916, $5\frac{1}{4}$ acres in 1917, $2\frac{1}{4}$ acres in 1918, 4 acres in 1919. It is divided into 7 blocks, viz. :—

Top block.—Area $1\frac{3}{4}$ acres, planted in 1914 with Bush Apple trees $15' \times 15'$ diagonally.

North block.—Area $1\frac{1}{2}$ acres, planted in 1914 with Standard Apple trees $34' \times 34'$ diagonally, interplanted with Bush Apple trees $17' \times 17'$.

South block.—Area $5\frac{1}{4}$ acres, planted with Standard Apple trees $30' \times 30'$ diagonally, interplanted with Bush Apple, Pyramid Pear, Cherry and Plum trees $15' \times 15'$, $\frac{3}{4}$ acre planted in 1914, $\frac{1}{4}$ acre in 1915, $\frac{1}{2}$ acre in 1916, $2\frac{3}{4}$ acres in 1917, 1 acre in 1918.

East block.—Area $8\frac{1}{4}$ acres ; 7 acres is planted with Standard Apple trees $34' \times 34'$ diagonally, interplanted with Bush Apple trees $17' \times 17'$; $5\frac{1}{2}$ acres planted in 1914, $1\frac{1}{2}$ acres planted in 1915. The remaining $1\frac{1}{4}$ acres was planted in 1918 with Standard Pear trees $25' \times 25'$ diagonally.

South-west block.—Area 4 acres, planted in 1919 with Standard Apple trees $30' \times 30'$ diagonally, partly interplanted with Bush Apple and Plum trees $15' \times 15'$.

East block extension.—Area $2\frac{1}{2}$ acres, planted in 1917 with Standard Apple trees $30' \times 30'$ diagonally, interplanted with Bush Apple trees $15' \times 15'$.

West block.—Area $1\frac{1}{4}$ acres, planted with Standard Pear trees $25' \times 25'$ diagonally, interplanted with Bush Pear trees $12' 6'' \times 12' 6''$; 1 acre planted in 1914, $\frac{1}{4}$ acre in 1915.

The soil of the Upper Garden is a good loam of about 12 inches depth lying on a red sub-soil. Small plots have a hard pan sub-soil about $2\frac{1}{2}$ feet from the surface. The whole of the planted area has been terraced with stone and banks. It has successfully prevented the denudation of the soil by rainfall.

The following statement shows the varieties of the Apples and Pears grafted in 1916 and 1917 :—

Varieties and Stock.	North block.		Top block.		East block.		West block.	
	1916.	1917.	1916.	1917.	1916.	1917.	1916.	1917.
1.	2.	3.	4.	5.	6.	7.	8.	9.
APPLES GRAFTED ON CRAB STOCK.								
Bismarck	245	...	...	49	31	...	...
James Grieve	827	...	...	73	111	...	...
Kerry Pippin...	86	...	...	52	78	...	...
Lane's Prince Albert	15	29	...	...
Rev. W. Wilks	79	...	104	7	12	10	...
Stirling Castle	91	...	...	4	3	...	...
Red Victoria...	7	46	...	...
Crimson Bramley's Seedling.	24	36	...	...
Bramley's Seedling	20	22	...	...
Alfriston	49	131	...	...
Bess Red	25	58	...	...
Rival	48	69	...	...
Domino	55	65	...	...
Norfolk Beauty	53	...	...	...	...	...	...
Total	1,404	...	104	419	687	10	...

[illegible]

The following varieties of Apples in this garden have so far yielded best of the Bush trees:—James Grieve, Lane's Prince Albert, Upton Pyne, Bismarck, Rev. W. Wilks, Domino, Sturmer Pippin, William's Favourite, Kerry Pippin, Peasgood's Non-such, Lady Sadely, Encore, Bramley's Seedling, Newton Wonder, Charles Ross, Alfriston, Boston Russet, Royal Snow, Wadhurst Pippin, Eckinville Seedling, Allington Pippin, William Crump, Irish Peach, Lord Grosvenor, Jefferson.

A few varieties of the Standard trees fruited for the first time; the trees have put on good growth. The following varieties of Pears fruited:—Fertility, Princess, Marguerite Marillat, William's Bon Chretien, Boyenne d' Ete, Charles Ernest, Dr. Jules Guyot, Durondeau, Bourre d' Amanlis, Colmar d' Ete, Belle Julie, Fondante Thirriot. The trees have put on a better growth than the Lower Garden ones, and the site of the West Block appears to be favourable: the trees are too young to judge as to quality and yield; only the stronger trees were allowed to set a few fruit and these were promising. None of the English Plums bore fruit and growth was poor; the American varieties—Shiro, Gold, Omaha—have grown well and bore a few fruits of good quality. None of the Orange trees have yet borne fruit. The whole area of this garden has been kept well cultivated, and the trees have put on very satisfactory growth. The Strawberry crop owing to the drought was a failure. New beds of "Royal Sovereign" have been planted in the South Block. Pruning commenced on the 2nd January and was finished on the 28th February. The deep hoeing was finished on the 7th March. Four acres was added to the planted area this year. The whole of the planted area has been fenced with wire fencing.

The following trees are in Nurseries for future planting:—

Description.	South Block 1915 and 1916 trees.	South Block 1917 trees.	East Block 1915 trees from Kashmir.	East Block 1915 and 1916 trees.	Total.
1	2	3	4	5	6
Standard Apple trees ...	140	22	92	152	406
Bush " " ...	...	10	...	...	10
Standard Pear " ...	...	12	1	...	13
Sweet Chestnut ...	3	...	...	...	3
Pecan Nut ...	6	...	...	...	6

The establishment consists of an Overseer and a part time clerk each on a monthly salary of Rs. 25, 2 Khasi Apprentices, and 8 Khasi Malis on a monthly salary of Rs. 15 each. All have worked well and take great interest in their work.

4. *Varieties planted.*—The following statement shows the number and varieties of fruit trees planted :—

Species of fruit trees.	Variety.	Planted 1913-19.							Total number.	Description.
		Upper garden.					Lower garden.	South-west block.		
		Top block.	South block.	East block.	North block.	East extension.				
1	2	3	4	5	6	7	8	9	10	11
	James Grieve	59	76	111	58	...	41	...	351	
	Boston Russet	...	2	12	...	...	...	...	14	
	Bens Red	...	...	10	10	...	9	...	29	
	Alfriston	...	...	29	...	...	6	...	37	
	Egremont Russet	10	...	...	8	1	...	...	19	
	Annie Elizabeth	...	...	20	...	...	...	...	20	
	Claygate Pearmain	8	...	...	10	...	...	...	18	
	Lord Hindlip	...	...	10	...	...	...	...	10	
	Mannington Pearmain	6	...	...	8	2	4	...	20	
	Winter Queen of Kent.	...	...	10	...	...	...	...	10	
	Pineapple Russet	...	...	...	9	...	...	...	9	
Apples	Edward VII	...	...	8	...	...	...	...	8	
	Red Juneating	6	...	1	2	...	10	...	19	Bush.
	Flower of Kent	...	...	8	...	...	...	...	8	
	Cornish Pine	...	8	...	...	...	...	...	8	
	Tower of Glamsis	...	...	...	...	6	...	...	6	
	Winter Banana	...	...	...	...	3	...	...	3	
	Wolf River	...	...	...	...	3	...	...	3	
	Chelmsford Wonder	...	...	...	...	6	...	...	6	
	Byford Wonder	...	...	...	...	10	...	...	10	
	Ruddy	...	...	...	...	6	...	...	6	
	Ormeau Pearmain	...	...	...	...	6	...	...	6	
	Hambleton deux ans	...	...	...	...	5	...	...	5	
	Bellevue Pontoise	...	...	...	...	5	...	...	5	
	Barnack Beauty	...	...	...	4	8	5	...	19	

Species of fruit trees.	Variety.	Planted 1913-19.							Total number.	Description.
		Upper garden.					Lower garden.	South-west block.		
		Top block.	South block.	East block.	North block.	East extension.				
1	2	3	4	5	6	7	8	9	10	11
Apple trees	Coronation	6	4	...	5	...	78	Bush.
	Wealthy	...	...	...	4	...	6	...	10
	Feltham Beauty	...	...	10	...	...	...	...	10
	Norfolk Beauty	...	8	33	...	10	...	10	61	
	Saaspariel	...	...	3	...	...	...	...	3
	Guelph	...	...	1	...	...	...	...	1
	Peacemaker	...	...	1	...	...	...	...	1
	Roseberry	...	...	1	...	...	...	...	1
	Christmas Pearmain	...	...	10	...	...	...	...	10
	Yorkshire Beauty	...	5	...	...	1	...	...	6
	Kings Acre Pippin	...	...	5	...	...	...	...	5
	Crimson Bramley	...	15	...	18	...	...	5	88
	Royal Snow	...	...	...	10	...	...	...	10
	Bramley's Seedling	...	15	...	16	...	...	14	44
	Kings of Tompkins County.	...	1	...	5	2	...	...	11
	Houblon	...	...	...	6	...	...	...	6
	Roundway Magnum Bonum.	...	6	...	...	...	...	2	8
	Wellington	...	...	...	5	...	...	...	5
	Lane's Prince Albert	...	14	2	17	...	10	11	54	
	Upton Pyne	...	1	3	6	...	25	6	41	
	Devon Queen	...	4	1	2	...	2	...	9	
	Renown	...	...	4	...	...	6	...	10
	Stirling Castle	...	10	...	10	...	...	...	20
	Golden Russet	...	...	...	6	...	...	...	6
	Charles Ross	...	10	...	10	...	11	...	31	
	Bismarck	...	...	1	17	3	...	10	46
	Rymer	...	6	...	...	...	...	...	6
Warner's King	...	...	...	...	...	...	11	11	
Thomas Rivers	...	10	...	...	...	...	...	10	
Grenadier	...	...	2	14	...	...	3	19	
Rev. W. Wilks	...	19	...	6	...	...	6	47	
Hounslow Wonder	...	...	1	20	...	...	6	27	

Species of fruit trees.	Variety.	Planted 1913-19.							Total number.	Description.
		Upper garden.					Lower garden.	South-west block.		
		Top block.	South block.	East block.	North block.	East extension.				
1	2	3	4	5	6	7	8	9	10	11
	Newton Wonder ...	15	...	21	...	...	16	...	52	
	Red Victoria ...	...	4	11	...	3	10	...	28	
	Potts' Seedling ...	4	...	6	...	...	10	...	19	
	Hector McDonald ...	...	...	20	...	...	19	...	30	
	Emperor Alexander ...	...	9	...	...	...	...	...	9	
	Sandringham ...	...	...	...	...	5	...	...	5	
	Rougemont ...	...	...	...	...	6	...	...	6	
	Hamblings Seedling ..	...	...	...	...	6	...	...	6	
	Gabalva ...	...	...	...	...	6	...	...	6	
	Baron Wolsely ...	...	...	...	...	6	...	...	6	
	Loddington Seedling ...	...	...	...	...	6	...	...	6	
	Paroquet ...	...	...	...	...	6	...	...	6	
	Domino ...	13	...	...	...	...	...	...	18	
	Rival ...	...	...	16	...	12	...	...	28	
	Wadhurst Pippin ...	10	...	...	...	...	...	...	10	
	Court Penda Plat ...	6	...	6	...	...	...	...	13	Bush.
	Ecklinville Seedling ...	4	...	4	...	...	...	...	8	
	Early Red Margaret ...	...	...	10	...	...	...	...	10	
	Gascoyne's Scarlet ...	4	...	5	...	...	...	...	9	
	Spitzenberg ...	...	...	6	...	...	...	...	6	
	Braddicks Nonpareil...	5	...	...	...	...	...	...	5	
	White Nonpareil ...	10	...	...	...	...	...	...	10	
	Baumann's Reinette...	6	7	8	...	4	...	...	23	
	Pitmaston Pineapple ...	10	...	...	...	...	...	...	10	
	Brownlee's Russet ...	10	...	...	...	...	...	...	10	
	Sturmer Pippin ...	5	6	16	...	...	20	...	47	
	Cardinal ...	...	...	9	1	...	...	...	10	
	Emneth Early ...	...	3	14	...	8	...	...	25	
	Langley Pippin ...	...	...	10	...	...	...	...	10	
	Wagener ...	...	...	9	...	...	...	...	9	
	Williams' Favourite...	10	...	...	...	...	...	...	10	
	Scarlet Nonpareil ...	...	...	10	...	...	12	...	22	

Species of fruit trees.	Variety.	Planted 1913-19.							Total number.	Description.
		Upper garden.					Lower garden.	South-west block.		
		Top block.	South block.	East block.	North block.	East extension.				
1	2	3	4	5	6	7	8	9	10	11
Apple trees	Lord Burghley	1				4	2		7	
	St. Everard		6			5			11	
	Beauty of Bedford		4			7			11	
	Reinette doree de Heusgen.	10							10	
	Coe's Golden Drop						6		6	
	Cox's Orange Pippin		7				23		30	
	Kerry Pippin		10	16			10		36	
	Golden Reinette						6		6	
	Peasgood's Nonsuch			25			14		39	
	Fearn's Pippin			12			6		18	
	Lady Sudeley			20			10		30	
	Devonshire Quarrenden						15		15	
	May Queen		10						10	
	Royal Jubilee		10						10	
	Missing Link		1						1	
	Roseberry		1						1	Bush.
	Crawley Beauty		1						1	
	Mrs. Phillimore						6		6	
	Lord Grosvenor						6		6	
	Blue Pearmain						4		4	
	Jefferson						7		7	
	Star of Devon						20	5	26	
	Yellow Ingestre							6	6	
	Ardeairu Russet		7	5	1	11	5		29	
	Allington Pippin		16	5			4		25	
	William Cramp		10	19		9	6		44	
	Worcester Pearmain						6		6	
	Herring's Pippin	4	6	3		52	1		66	
	Beauty of Bath		5	5			1		11	
	Ellison Orange					16	1		17	
	Ribston Pippin		4				1		19	
	Charles Eyre			3		9	6		19	
							7			

Species of fruit trees.	Variety.	Planted 1913-19							Total number.	Description.
		Upper garden.					Lower garden.	South-west block.		
		Top block.	South block.	East block.	North block.	East extension.				
1	2	3	4	5	6	7	8	9	10	11
	Fyke House Russet	6	...	6	Bush.
	Spring Ribston Pippin ...	...	...	8	...	...	...	...	8
	Mr. Gladstone ...	...	...	6	...	...	5	...	11
	Golden Spire ...	...	14	...	...	9	...	...	23
	Rosemary Russet ...	...	...	6	...	...	6	...	12
	Duke of Devonshire ...	...	6	...	...	...	...	...	6
	Early Peach ...	...	10	...	...	...	...	...	10
	Newtown Pippin ...	...	2	8	...	...	6	...	6
	American Mother ...	...	9	...	...	...	...	...	9
	Encore ...	...	...	13	...	...	4	...	22
	Irish Peach ...	...	6	...	...	...	...	...	6
	Lord Stradbroke ...	...	...	...	...	6	...	...	6
		Total ...	340	813	792	142	354	430	47		2,418
Apple trees ...	Encore	6	5	11	Standards.
	Crimson Bramley ...	...	5	3	10	...	...	...	18
	Rymor ...	...	...	...	...	...	8	...	8
	Bramley's Seedling ...	...	...	8	12	...	...	...	20
	Court of Wick ...	...	...	6	...	...	...	...	6
	Irish Peach ...	...	...	...	6	...	...	...	6
	Northern Greening ...	...	...	...	...	...	7	1	8
	Norfolk Reeling ...	...	...	...	6	...	...	...	6
	Newton Wonder ...	...	4	21	...	...	...	...	25
	Stirling Castle ...	...	...	5	1	...	2	3	11
	Allington Pippin ...	...	...	...	...	...	...	...	...
	Annie Elizabeth ...	...	...	...	...	9	...	1	10
	Ellison's Orange ...	...	...	...	...	6	...	4	19
Chelmsford Wonder ...	...	...	...	...	8	...	...	6	
Lord Grosvenor ...	...	...	...	...	7	...	2	9	
Christmas Pearmain ...	...	...	...	...	10	...	...	10	
Baldwin ...	...	...	...	...	...	6	8	19	

Species of fruit trees.	Variety.	Planted 1913-19.							Total number.	Description.
		Upper garden.					Lower garden.	South-west block.		
		Top block.	South block.	East block.	North block.	East extension.				
1	2	3	4	5	6	7	8	9	10	11
Apple trees ...	Beauty of Kent	8	8	Standard.
	Duchess of Oldenburg ...	...	...	6	...	...	...	...	6
	Norfolk Bearer ...	...	...	5	1	...	...	...	6
	King of Tompkins County.	...	...	6	...	...	...	...	8
	Emperor Alexander ...	...	...	...	6	...	...	...	8
	James Grieve ...	...	3	17	...	...	...	...	20
	Cox's Pomona ...	...	...	2	4	...	...	...	6
	Small's Admirable ...	...	...	6	...	...	...	...	6
	New Hawthorden ...	...	...	4	...	...	...	...	4
	Calville St. Saumur ...	...	7	...	...	...	8	...	15
	Reinette de Cazy ...	...	8	...	...	...	5	...	13
	Precoco David ...	...	3	...	...	...	2	...	5
	Kashmir Amroo ...	...	3	...	...	...	...	...	3
	Fenouillet Gris ...	...	4	...	...	...	4	5	13
	Api Petit ...	1	4	1	...	...	2	...	8
	Delicious (Starks) ...	...	50	12	...	...	...	...	62
	King David ...	...	26	13	...	...	...	36	75
	York Imperial ...	...	...	6	...	...	...	...	6
	Paragon Winesap (Starks).	...	...	5	...	...	...	...	5
	Jonathan (Starks) ...	...	2	6	...	...	...	...	8
	Black Ben (,,) ...	...	20	5	...	...	...	35	60
	Stayman Winesap (Starks).	...	...	6	...	...	...	18	24
	Senator (Starks) ...	...	1	4	...	...	...	...	5
	Grimes Golden (Starks)	...	12	5	...	...	...	12	29
	Summer Champion (Starks).	...	2	...	...	...	...	...	2
	Mother (Starks) ...	...	...	8	...	...	...	...	6
	Emmett Early ...	...	...	10	...	...	...	...	10
	Baumann's Reinette...	...	...	10	...	...	...	...	10
	Grenadier ...	...	...	8	...	...	...	...	8
	Cox's Orange Pippin...	...	...	15	...	...	...	...	15

Special of fruit trees.	Variety.	Planted 1913-19.							Total number.	Description.	
		Upper garden.					Lower garden.	South-west block.			
		Top block.	South block.	East block.	North block.	East extension.					
1	2	3	4	5	6	7	8	9	10	11	
Apple trees ...	Red Victoria	5	6	Standards.	
	Blenheim Orange	...	3	8	...	...	...	...	11
	Calville Blanc	...	...	6	...	...	...	...	8
	Norfolk Beauty	...	16	14	1	...	...	...	39
	Reinette du Canada...	...	6	4	...	...	2	3	16
	Winter Greening	...	8	...	...	...	...	...	8
	Rev. W. Wilks	...	1	...	...	29	6	3	39
	Lord Burghley	...	6	...	...	...	...	...	6
	Lady Henniker	...	4	6	...	...	...	...	10
	Golden Spire	...	4	4	...	...	...	...	8
	Bismarck	...	4	6	...	...	...	...	10
	Calville Rouge d'hiver	...	6	...	...	1	14	10	31
	Charles Ross	...	3	2	...	4	...	6	15		
	Lord Derby	...	...	...	...	...	...	8	8
	Barnack Beauty	...	...	1	...	6	3	4	14
	Herrings Pippin	...	3	...	...	16	...	...	19
	Rival	...	2	...	...	6	...	7	15
	Star of Devon	...	...	...	...	4	...	2	6
	William Crump	...	...	...	...	5	...	...	5
	Upton Pyre	...	...	...	...	15	...	5	20
	Early Melon (Starks)...	...	...	4	...	...	...	...	4
	Wealthy ( " )...	...	...	4	...	...	...	...	4
	Wilson's Red June (Starks).	...	...	6	...	...	...	...	6
	Liveland Raspberry (Starks).	...	...	6	...	...	...	...	6
	Worcester Pearmain...	...	...	...	...	...	...	...	...
	Tower of Glamis	...	...	...	...	...	...	6	6
	Total	...	1	239	272	47	124	77	195		946
	Blenheim Orange	1	11	12	Horticultural trained.
	James Grieve	4	...	4	
	Feltham Beauty	2	3	5	
	Lady Sudeley	...	2	3	...	5	
	Herring's Pippin	2	1	...	2	...	5	

Species of fruit trees.	Variety.	Planted 1913-19.						Total number.	Description.
		Upper garden.					Lower garden.		
		Top block.	South block.	East block.	North block.	East extension.			
1	2	3	4	5	6	7	8	9	10
Apple trees	Gascogne's Scarlet ...	3	3	3	Horizontal trained.
	Charles Ross ...	3	...	...	...	...	...	3
	Brownlee's Russet ...	3	...	...	...	...	2	5
	Baumann's Reinette...	3	...	...	...	...	...	3
	Beauty of Bath ...	...	...	...	...	...	5	5
	Sturmer Pippin ...	6	...	...	...	...	...	6
	Cox's Orange Pippin...	...	...	...	...	...	1	1
	Cox's Pomona ...	1	...	...	...	...	3	4
	King of the Pippins ...	...	...	3	...	...	2	5
	Kerry Pippin ...	...	...	...	...	...	1	1
	Clisgate Pearmain ...	...	...	...	...	...	1	1
	King of Tompkins County.	...	...	3	...	...	...	3
	Sterling Castle ...	...	...	...	...	...	3	3
	Total ...	21	...	11	15	...	27	74	
	Sturmer Pippin	3	3	Upright trained.
	Mannington Pearmain	...	...	...	3	...	...	3
	Scarlet Golden Pippin	...	...	...	...	...	2	2
	Washington ...	2	...	2	2	...	...	6
	Allington Pippin ...	...	...	...	...	...	2	2
	Golden Spire ...	...	...	1	...	...	...	1
	Beauty of Bath ...	...	...	...	...	...	2	2
	Adams Pearmain ...	2	...	...	1	...	...	3
	James Grieve ...	...	...	...	...	...	2	2
	King of the Pippins...	...	...	2	1	...	...	3
	Barnack Beauty ...	...	...	...	...	...	2	2
	King of Tompkins County.	...	...	...	5	...	...	5
	Total ...	4	...	5	15	...	10	34	

Species of fruit trees.	Variety.	Planted 1913-19.						Total number.	Description.	
		Upper garden.					Lower garden.			
		Top block.	South block.	East block.	North block.	East extension.				
1	2	3	4	5	6	7	8	9	10	
Apple trees	Charles Ross	6	6	Palmetto Verrier-trained.
	Rival	...	...	...	5	...	...	...	5
	James Grieve	...	...	...	6	...	...	...	6
	Blenheim Orange	...	...	...	6	...	...	...	6
	Total	23	23	
	Baumann's Reinette...	4	4	Fan trained.
	Golden Spire	...	...	1	...	...	...	...	1
	Total	5	5	
	Rival	3	3	Double Cordon.
	Total	...	...	...	3	...	...	...	3
	Rival	3	3	Single Cordon.
	Total	...	...	...	3	...	...	...	3

Species of fruit trees.	Variety.	Planted 1913-19.					Total number.	Description.
		Upper garden.				Lower garden.		
		Top block.	West block.	South block.	East block.			
1	2	3	4	5	6	7	8	9
Pear trees.	Fertility ...	..	53	1	...	18	72	
	St. Swithins ...	...	...	...	...	10	10	
	Beurre Hardy ...	...	17	1	...	2	20	
	Rod October ...	...	...	...	...	8	8	
	Beurre d'Anjou ...	...	6	...	...	...	6	
	Parrot ...	...	...	...	...	10	10	
	William's Bon Christien ...	...	13	...	...	...	13	
	Seedling Bergamot ...	...	...	...	...	6	6	
	Fondante Thiriot ...	...	10	...	...	10	20	
	Dr. Hogg ...	...	...	...	...	7	7	
	Triomphe de Vienne ...	...	6	...	...	...	6	
	Beacon ...	...	...	4	...	6	10	
	Beurre de Nagan ...	...	...	...	...	8	6	
	Charles Ernest ...	...	12	...	...	...	12	
	Roosevelt ...	...	...	...	...	6	6	
	Doyenne d'Ete ...	...	10	...	...	...	10	
	Blickling ...	...	...	...	...	6	6	Bush and Pyramid.
	Gansels Bergamot ...	...	6	...	...	...	6	
	Santa Claus ...	...	...	...	...	6	6	
	Josephine de Malines ...	...	6	...	...	9	15	
	Precoc de Juillet ...	...	...	...	...	5	5	
	Dr. Jules Guyot ...	...	11	...	...	6	17	
	Madame Treve ...	...	...	...	...	10	10	
	Dunrobdau ...	...	7	1	...	2	10	
	Hessle ...	...	5	...	...	14	19	
	Beurre d'Amanlis ...	...	12	...	...	10	22	
	Emile d'Heyst ...	...	6	...	...	10	15	
	Marie Benoist ...	...	6	...	...	...	6	
	Clapp's Favourite ...	...	6	...	...	10	15	
	Louise Bonne of Jersey ...	...	2	...	...	...	2	
	President Barabe ...	...	6	...	...	...	6	
	Thompson ...	...	5	...	...	...	5	
	Winter Nellie ...	...	4	...	...	...	4	
	Marguerite Marillat ...	...	6	...	...	...	6	
	Sockle ...	...	...	6	...	...	6	
	Beurre Fonqueray ...	...	...	6	...	...	...

Species of fruit trees.	Variety.	Planted 1913-19.					Total number.	Description.
		Upper garden.				Lower garden.		
		Top block.	West block.	South block.	East block.			
1	2	3	4	5	6	7	8	9
Pear trees	Directeur Hardy	5	5	Bush and Pyramid.
	Colmar d'Ete ...	...	5	6	...	...	12
	Princess ...	...	5	6	...	...	12
	Belle Julie ...	...	6	6	...	...	12
	Doyenne du Comice ...	...	1	4	...	...	5
	Total	231	46	...	177	454	
	Beurre Hardy	13	5	18	Single Cordon.
	Clapp's Favourite ...	...	10	...	...	...	10
	Durondeau ...	...	9	...	...	...	9
	Madame Treve ...	...	10	5	...	...	15
	William's Bon Chretien ...	...	7	...	...	5	12
	Marguerite Marillat ...	...	14	...	...	5	19
	Doyenne du Comice ...	...	10	...	...	5	15
	Fondante Thiriot ...	...	...	5	...	...	5
	Louise Bonne of Jersey ...	...	10	...	...	2	12
	Conference ...	...	9	...	...	5	14
	Emile d'Heyst ...	...	9	...	...	...	9
	Winter Nellis ...	...	6	...	...	...	5
	Fondante d'Automne ...	...	...	5	...	...	5
	Beurre Superfin ...	...	...	...	...	5	5
	Princess ...	...	...	5	...	5	10
	Beurre Fouquetay ...	...	...	5	...	...	5
	Beurre Diel ...	...	...	...	...	5	5
	Directeur Hardy ...	...	...	5	...	...	5
	Beurre d' Anjou ...	...	...	...	...	5	5
	Colmar d'Ete ...	...	...	5	...	...	5
	Total	106	35	...	47	158	
	Directeur Hardy	5	5	10	Horizontal trained.
	Duchess d'Angouleme ...	...	1	...	...	...	1
	Clapp's Favourite ...	...	2	...	...	...	2
	Josephine de Malines ...	...	1	...	...	...	1
	Emile d'Heyst ...	...	2	...	...	...	2
	Louise Bonne of Jersey ...	...	1	...	...	...	1

Species of fruit trees.	Variety.	Planted 1913-18.					Total number.	Description.
		Upper garden.				Lower garden.		
		Top block.	West block.	South block.	East block.			
1	2	3	4	5	6	7	8	9
Pear trees.	Beurre Superfin	1	1	Horizontal trained.
	Princess ...	...	6	...	...	...	6
	Conference ...	...	2	...	...	...	2
	Dr. Jules Guyot ...	...	2	...	...	...	2
	Durondeau ...	...	1	...	...	...	1
	Pitmaston Duchess ...	...	1	...	...	...	1
	Fondante d'Automne...	...	1	...	...	...	1
	Doyenne du Comice ...	...	2	...	...	...	2
	Winter Nellis ...	4	...	...	...	...	4
	Marguerite Marillat ...	...	5	...	...	...	5
	Total ...	4	33	5	42	
	Kashmir	38	...	38	Standard.
	Marquerite Marillat ...	...	...	6	...	...	6
	King Karl (Starks) ...	...	1	...	3	1	5
	Anjou ( " ) ...	...	3	...	4	1	8
	Lincoln ( " ) ...	...	3	...	5	...	8
	Howell ( " ) ...	...	6	...	3	...	9
	Duchess ( " ) ...	...	3	...	1	1	5
	Bartlett ( " ) ...	...	8	...	4	1	13
	Seckle ( " ) ...	...	4	...	...	4	8
	Marie Louise ...	...	2	...	...	...	2
	Dr. Jules Guyot ...	...	5	11	...	...	16
	Conference ...	...	2	...	...	...	3
	Emile d'Heyst ...	...	2	...	...	...	3
	Madame Treve ...	...	8	...	...	...	8
	Count de Lamy ...	...	3	...	...	...	3
	Louise Bonne of Jersey ...	...	2	...	...	...	2
	Beurre Capiaumont ...	...	6	...	...	...	6
	Princess ...	...	2	...	...	...	2
	Doyenne du Comice...	...	2	...	...	...	2
	William's Bou Chretien ...	...	2	...	...	...	2
	Souvenir du Congress...	...	...	...	...	...	2
	Marie-Louise d'Ocicle...	...	...	...	...	...	2
	Fertility	28	...	8	...	

Species of fruit trees.	Variety.	Planted 1913-19.					Total number.	Description.
		Upper garden.				Lower garden.		
		Top block.	West block.	South block.	East block.			
1	2	3	4	5	6	7	8	9
Pear trees	Seckle	2	2	Standards.
	Bartlett Hybrid (Starks)	...	...	...	5	...	5
	Fame ( .. )	...	...	...	...	4	4
	Rehl Best ( .. )	...	...	...	4	3	6
	Boussock ( .. )	...	...	...	3	2	5
	Triumph ( .. )	...	...	...	4	...	4
	Winter Bartlett ( .. )	...	...	...	...	7	7
	Comice ( .. )	...	...	...	...	4	4
	Total ... ..	...	27	24	77	27	225
	Princesse	4	4	Upright trained.
	Conference ... ..	...	...	...	...	3	3
	Madame Treve ... ..	...	...	5	...	...	5
	Marie Louise d' Uccle	...	...	...	...	4	4
	Louise Bonne of Jersey	...	...	...	...	4	4
	Beurre Hardy	5	...	...	...	...	5
	Fondante d' Automne	...	...	...	...	3	3
	Winter Nellis ... ..	...	...	...	4	...	4
	Conseiller de la Cour...	...	...	...	...	3	3
	Doyenne du Comice...	...	...	...	...	3	3
	Marguerite Marillat...	4	1	...	...	...	5
	Total	9	5	5	4	20	43	

Species of fruit trees.	Variety.	Planted 1913-19.						Total number.	Description.
		Upper garden.				Lower garden.	South-west block.		
		Top block.	South block.	East block.	North block.				
1	2	3	4	5	6	7	8	9	10
Plum trees ...	Late Transparent	6	...	6	Bush.
	Guthrees Late Gage ...	...	4	...	...	...	...	4
	Demiston's Superb Gage.	...	3	...	...	10	...	13
	White Botan ...	...	1	...	...	...	2	3
	Satsuma ...	...	2	...	...	1	3	6
	Burbank ...	...	2	...	...	...	1	3
	Prosperity...	...	5	...	...	...	...	5
	Reine Claude de Bavay	...	3	...	...	...	...	3
	Belle de Louvain ...	...	...	...	...	6	...	6
	Curlew ...	...	5	...	...	...	...	5
	Utility ...	...	2	...	...	...	1	3
	Greengage...	...	1	...	...	5	...	6
	Coxe Emperor ...	...	4	...	...	...	...	4
	Heron ...	...	5	...	...	...	...	5
	Mitchelsons ...	...	3	...	...	...	...	3
	Monarch ...	...	...	...	3	...	...	2
	Ickworth ...	...	2	...	...	...	...	2
	Stark's Gold ...	...	3	...	...	...	...	3
	Diamond ...	...	3	...	...	...	...	3
	Belgian Purple ...	...	1	...	...	10	...	11
	Bittern ...	...	5	...	...	...	...	5
	Rutland Plumcot ...	...	1	...	...	...	...	1
	Primate ...	...	5	...	...	...	...	5
	Pond's Seedling ...	...	7	...	...	3	...	10
	Admiral ...	...	5	...	...	...	...	5
	Stark's Shiro ...	...	1	...	...	...	...	1
	President...	...	6	...	...	...	...	6
	Stark's Omaha ...	...	...	1	...	1	...	2
	Jefferson ...	...	2	...	...	...	...	2
	Autumn Beauty ...	...	...	1	...	...	...	1
	Wyedale ...	...	3	...	...	...	...	3
	King of the Damsons...	...	...	...	...	2	...	2
	Kirke Blue ...	...	3	...	...	...	...	3

species of fruit trees.	Variety.	Planted 1913-19.						Total number.	Description.
		Upper garden.				Lower garden.	South-west block.		
		Top block.	South block.	East block.	North block.				
1	2	3	4	5	6	7	8	9	10
	Shepherd's Bullace	3	...	3	Bush.
	Czar ...	...	6	...	...	...	...	6
	Langley's Bullace ...	...	...	...	...	3	...	3
	Victoria ...	...	6	...	...	...	...	6
	White Damson ...	...	...	...	...	3	...	3
	Prince Englebert ...	...	3	...	...	...	...	3
	Prune Shropshire ...	...	...	...	...	3	...	3
	Kashmir Greengage ...	...	4	...	...	...	...	4
	Merryweather Damson ...	...	...	...	...	10	...	10
	Count d'Altham gage... ..	...	1	...	...	...	...	1
	Stark's America ...	...	...	2	...	...	...	2
	Strut ...	...	1	...	...	...	...	1
	Burbanks Giant Prune ...	...	8	...	...	4	...	12
	Yellow Pershore ...	...	...	...	...	1	...	1
	Total ...	5	116	7	...	71	7	206	
July 1928 ...	Decaise	1	...	1	Fan trained.
	Kirkes ...	...	...	...	...	2	...	2
	Jefferson ...	...	...	...	...	2	...	2
	Mallard ...	...	...	...	...	1	...	1
	Golden Esperen ...	...	...	...	...	1	...	1
	Oullin's Golden Gage ..	...	...	...	...	2	...	2
	Reine Claude d'Altham.	...	...	...	...	1	...	1
	Early Transparent ...	...	...	...	...	1	...	1
	Coe's Golden Drop ..	...	...	...	...	1	...	1
	Transparent Gage ...	...	...	...	...	1	...	1
	Greengage ...	...	...	...	...	2	...	2
	Golden Transparent Gage.	...	...	...	...	1	...	1
	Belgian Purple ...	...	...	...	...	1	...	1
	Total ...	...	...	...	...	17	...	17

July 1928

Species of fruit trees.	Variety.	Planted 1913-19.						Total number.	Description.
		Upper garden.				Lower garden.	South-west block.		
		Top block.	South block.	East block.	North block.				
1	2	3	4	5	6	7	8	9	10
Cherry trees ...	Morello	16	...	3	3	...	22	Trees,
	Kentish ...	...	12	...	...	15	...	27
	Bigarreau Kentish ...	...	...	...	...	3	...	3
	Gloire de France ...	...	1	...	...	2	...	3
	White Heart ...	...	...	...	...	4	...	4
	Black Heart ...	...	...	...	...	5	...	5
	Kashmir ...	...	24	...	...	7	...	31
	Montmorency King ...	...	2	...	...	1	...	3
	Barbank ...	...	4	...	...	1	...	5
	Total ...	...	59	...	3	42	...	104
	Turkey Black Heart	1	...	1	Fan fruit...
	Late Black Bigarreau...	...	...	...	...	1	...	1
	Frogmore Bigarreau...	...	...	...	...	1	...	1
	Noir de Guben ...	...	...	...	...	1	...	1
	Belle de St. Trone ...	...	...	...	...	1	...	1
	Early Rivers ...	...	...	...	...	1	...	1
Orange trees ...	Total	6	...	6	Trees.
	Japanese Satsuma ...	...	1	...	...	1	...	2
	Japanese Kumquat ...	...	8	...	...	4	...	12
	Malta Blood ...	...	14	...	...	2	...	16
	St. Michael's ...	...	13	...	...	1	...	14
	Jaffa ...	...	2	...	...	1	...	3
	Malta Oval ...	...	2	...	...	1	...	3
	Silver ...	...	3	...	...	1	...	4
	Excelsior ...	...	1	...	...	1	...	2
	St. Michael's Tangierin.	...	1	...	...	5	...	6
	St. Michael's Dom Louisa.	...	1	...	...	2	...	3
	St. Michael's Sustain ..	...	1	...	...	1	...	2
	Ditto Achilles	...	...	...	...	1	...	1
	Total ...	...	47	...	...	21	...	68

Species of fruit trees.	Variety.	Planted 1913-19.						Total number.	Description.
		Upper garden.				Lower garden.	South-west block.		
		Top block.	South block.	East block.	North block.				
1	2	3	4	5	6	7	8	9	10
Lime and Lemon trees.	Kazla Lime	1	2	3	Trees.
	Imperial Lemon ...	...	...	...	...	2	...	2
	Gora Lime ...	...	2	1	...	...	...	3
	Bijou Lemon ...	...	...	...	...	4	...	4
	Kagzi Lime ...	...	4	...	...	...	...	4
	Total	7	3	...	6	...	16	
Walnut trees ...	Dwarf Prolific	7	10	17	Trees.
	Kashmir ...	...	6	2	...	...	...	8
	Total ...	...	13	2	...	...	10	25
Peach trees ...	Princess of Wales	3	3	Trees.
	Peregrine ...	...	...	...	...	3	11	14
	Alexander ...	...	...	...	...	3	10	13
	Duke of York ...	...	...	...	...	1	16	17
	Exquisite ...	...	...	...	...	...	2	2
	Late Devonian ...	...	...	...	...	2	...	2
	Lady Palmerston ...	...	...	...	...	2	...	2
	Kestrel ...	...	...	...	...	6	...	6
	Hales Early ...	...	...	...	...	3	...	3
	Total ...	...	...	...	3	20	30	62
Pitot trees ...	Superb (Starks)	1	...	1	Trees.
	Blenheim ...	...	...	...	...	6	...	6
	Kashmir ...	...	7	...	...	...	...	7
	Total ...	...	7	...	...	7	...	14

Species of fruit trees.	Variety.	Planted 1913-19.						Total number.	Description.	
		Upper garden.				Lower garden.	South-west block.			
		Top block.	South block.	East block.	North block.					
1	2	3	4	5	6	7	8	9	10	
Quince trees ...	Meeks Prolific	1	1	...	2	} Trees.
	Champion...	...	...	1	...	...	...	...	1
	Portugal ...	...	...	1	...	...	1	...	2
	Total	...	...	3	...	...	2	...	5
Almond trees ...	Hill Almond	12	12	}
	Total	...	...	12	...	...	...	...	12

Species of fruit trees.	Variety.	Planted 1913-19.					Total number.	Description.
		Upper garden.			Lower garden.	South-west block.		
		South block.	East block.	North block.				
1	2	3	4	5	6	7	8	9
Wimborif	6	...	6	Berries.
King's Acre Derry ...	.....	...	...	...	5	...	5
Loganberry ...	.....	...	...	...	3	...	3
Phenomenal ...	.....	...	...	...	3	...	3
Laxtonberry ...	.....	...	...	...	3	...	3
Blackberry...	Blowers ...	...	...	...	100	...	100
Ditto ...	Pyne's Giant Himalaya Berry of California.	100	...	100	Plants.
	Total ...	...	...	...	220	...	220
Strawberry	Given's late Prolific...	...	...	...	900	...	900
	Louis Gauthier ...	...	500	...	320	...	820
	Royal Sovereign ...	3,000	3,000	...	1,250	...	7,250	
	Total ...	3,000	3,500	...	2,500	...	9,000	
Currant ...	Boskoop Giant Black...	...	2	2	Bushes.
	Blacksmith ...	11	...	...	...	...	11
	Defender Black ...	...	1	...	...	...	1
	Victoria Black ...	5	...	...	...	...	5
	Southwell's Black ...	...	20	...	...	...	20
	White La Versaille ...	4	...	...	...	...	4
	Total ...	20	23	...	24	...	47	Trees.
Nut trees	White Filbert ...	...	...	...	2	...	2
	Red Filbert ...	...	...	...	3	...	3
	Prize Cob ...	...	...	...	3	...	3
	Kentish Cob ...	...	...	...	3	...	3
	Total ...	...	...	...	11	...	11

Species of fruit trees.	Variety.	Planted 1913-19.					Total number.	Description.
		Upper garden.			Lower garden.	South-west block.		
		South block.	East block.	North block.				
1	2	3	4	5	6	7	8	9
Grape Vines	Campbell's Early (Starks).	...	2	2	Vines
	Hicks (Starks)	...	3	...	...	...	3
	King (")	...	2	...	...	...	2
	Eclipse (")	...	1	...	...	...	1
	King Philip (")	...	2	...	...	...	2
	Wilder (")	...	2	...	...	...	2
	Worden (")	...	2	...	...	...	2
	Niagara (")	...	2	...	...	...	2
	Total	...	16	16	

Summary of Fruit Trees planted to 31st March 1919.

							Total.
1							2
Bush Apple trees	...	...	...	...	...	...	2,418
Standard "	"	"	...	...	...	...	946
Horizontal trained Apple trees	...	...	...	...	...	...	74
Upright	"	"	"	...	...	...	34
Palmetto Verrier	"	"	"	...	...	...	23
Fan	"	"	"	...	...	...	5
Double Cordon	"	"	"	...	...	...	3
Single	"	"	"	"	...	...	3
Bush and Pyramid Pear	"	...	...	...	...	...	454
Single Cordon	"	"	...	...	...	...	188
Horizontal trained	"	"	...	...	...	...	37
Standard	"	"	...	...	...	...	225
Upright trained	"	"	...	...	...	...	43
Bush Plum trees	...	...	...	...	...	...	206
Fan trained Plum trees	...	...	...	...	...	...	17
Cherry standard trees	...	...	...	...	...	...	104
Cherry fan trained trees	...	...	...	...	...	...	6
Orange trees	...	...	...	...	...	...	68
Lemon "	"	...	...	...	...	...	16
Walnut "	...	...	...	...	...	...	25
Peach	"	...	...	...	...	...	62
Apricot	"	...	...	...	...	...	14
Quince	"	...	...	...	...	...	5
Almond	"	...	...	...	...	...	12
Wileberry	...	...	...	...	...	...	6
King's Acieberry	...	...	...	...	...	...	5

							Total.
1							2
Loganberry	...	...	...	...	...	...	3
Phenomenal Berry	...	...	...	...	...	...	3
Laxtonberry	...	...	...	...	...	...	3
Blower's Blackberry	...	...	...	...	...	...	100
Giant Himalaya Blackberry	...	...	...	...	...	...	100
Strawberry plants	...	...	...	...	...	...	9,000
Currant Bushes	...	...	...	...	...	...	43
Nut	...	...	...	...	...	...	11
Grape Vines	...	...	...	...	...	...	16

Statement showing the Receipts and Expenditure of the Fruit Experiment Station, Shillong, from 1st July 1918 to 31st March 1919.

Receipts.	Amount.	Expenditure.	Amount.
1	2	3	4
	Rs. a. p.		Rs. a. p.
Sale-proceeds of Apples ...	719 8 0	Allowance to Superintendent	3,000 0 0
" of Pears ...	26 0 0	Establishment ...	1,765 0 0
" of Peaches...	15 0 0	Petty construction ...	491 12 3
" of Strawber- ries.	15 0 0	Seeds, Plants and Manures	125 5 0
" of Damsons...	5 0 0	Instruments, Appliances, Apparatus and Machinery.	88 0 0
		Wages of labourers ...	4,858 8 6
		Service postage ...	30 0 0
		Other charges ...	519 2 0
Total Receipts ...	780 8 0	Total Expenditure ...	10,877 11 9

C. H. HOLDER,

*In charge, Fruit Experiment
Station, Shillong.*

The 15th May 1919.

REPORT OF THE KARIMGANJ AGRICULTURAL EXPERIMENT STATION FOR NINE MONTHS ENDING THE 31st MARCH 1919.

This station was established in January 1914. It is situated on the Sylhet Road, $3\frac{1}{2}$ miles to the west of the subdivisional station of Karimganj, which lies on the Assam-Bengal Railway.

The total area of the farm is a little under 80 acres. Leaving out a compact block of 8 acres which has been set apart for the farmstead and quarters for the staff, and the area covered by roads and drains estimated at 4 acres, the net area available for cultivation is about 68 acres.

The station is devoted mainly to experimental work on rice and jute.

2. The farm lies close to the Langai river which occasionally rises in high flood and lays the country all round under water. This liability to floods is characteristic of the rice lands in the locality.

The soil of the greater portion of the farm is a deep alluvial clay of fine texture, though not particularly heavy. In the higher lands, it is somewhat lighter in character and may be described as a medium loam.

A representative sample of the soil of the farm has recently been sent for analysis to the Agricultural Chemist to the Assam Administration and the results are being awaited with interest.

3. No changes were made in equipment during the year although several much needed works have been kept pending owing to the impossibility of procuring materials unless at exorbitant rates. The godown space on the farm is now proving quite inadequate, and arrangements are being made to increase it soon. It is also proposed to erect permanent quarters, instead of the temporary building which has been used to accommodate some of the farm apprentices during the last two years. In the past cold weather about one lakh of bricks has been prepared so that some of this work may be started at the earliest possible date.

The number of working cattle now stands at 28 compared with 32 last year. Two bullocks were transferred to the Upper Shillong Farm, four old bullocks were sold, and four younger ones bought to replace them.

With the object of acclimatizing the Shillong bulls in the plains, three more have been brought down making, with the stud bull brought in the present year, four now on the farm. The cost of feeding will be much less than at Shillong. The animals will be given light work and when they have become acclimatized and have shown signs of activity they will be sold off for breeding purposes. This of course will necessitate increased expenditure under the budget head "Feed of cattle" for which provision will have to be made.

4. The official agricultural year was found extremely inconvenient for the purpose of report, as it covered the latter half of one *kharif* season, the first half of the *kharif* season following, and the *rabi* season intervening. In consequence the Local Administration was moved to allow a change to be made in the agricultural year so that it should correspond with the financial year and end on 31st March. This has now been done and the present report deals with the period from July 1st, 1918, to 31st March 1919. The following table shows the rainfall during each month of this period :—

				Actual.	Normal.
1				2	3
July 1918	...	...	...	44.11	23.11
August "	...	...	...	21.37	22.83
September "	...	...	...	19.86	18.58
October "	...	...	...	3.98	8.31
November "	...	...	...	...	1.31
December "	...	...	...	.11	0.56
January 1919	...	...	...	.18	0.75
February "	...	...	...	.43	1.46
March "	...	...	...	.52	8.80
Total				90.56	85.71

Heavy and continuous rainfall in July caused floods in the district and injured the crops. Part of the *asra* and *sail* crops on the farm were destroyed but there was still sufficient time to replant and, as plenty of seedlings were available, this was done as soon as the fall of water permitted. Although some injury was caused by the continuous high floods having delayed replanting, on the whole the yields were good.

The total rainfall from the 17th October 1918 to the 31st March 1919 was only one and a quarter inches; as a result *raib* crops were again almost a complete failure.

5. As befits a station situated in such an extensive rice-growing district as the Surma Valley, attention is devoted mainly to effecting improvements in this staple.

Rice breeding. Rice-breeding experiments were arranged in 1914, after consultation between Mr. A. G. Birt, Deputy Director of Agriculture, Rai Bahadur B. C. Basu, Special Officer for Agriculture, and Mr. G. P. Hector, Economic Botanist, Bengal. These experiments have been carried on since.

An account of the methods adopted, together with the various modifications which circumstances have since rendered necessary will be found in the previous annual reports. The selection work is now being restricted to early broadcast *Aus* and transplanted winter rice. The latter known by the general name of *sail* forms the most important class of rice grown in the province.

In the past two years a number of types of both *aus* and *sail* has been discarded as unsuitable; the remaining types were retained as having one or more good qualities to recommend them. With the object of selecting one or two of the heaviest yielding types of each class the following method is now being adopted for this season's work. A few of the types in each class which have shown specially good qualities will be selected for a thorough and final test. In this test one good type will be taken as a standard, and each of the other types will be grown alongside the standard type twenty five times. Small plots will of necessity be used; each one will consist of 14 lines of 14 plants or 196 plants in all. By repeating the tests in this way, accidental differences due to soil or water level will be eliminated and the average of the yields obtained should be a reliable indication of the cropping powers of each type tested.

Fifty-six types of early broadcast *aus* are now being dealt with. These have been grown side by side since the work was started, and from a comparison of their cropping and other

qualities have now been divided into two lots. One lot contains ten types and resembles the Dumai sub-class, which is one of the quickest maturing classes of rice known. The other lot contains 46 types and resembles the Murali sub-class. Three types have been selected from among the first lot, and six from the second lot, as showing heavier yields than the remainder from the averages obtained in the past three years. These will be tested in the coming season according to the abovementioned method. At the same time all our *aus* varieties, 56 in number, will be kept under observation in the present season by growing a further generation of pure line seed in standard plots of 196 plants.

From the *sail* types which we have tried up to date, a total of 109 was grown in a single series of standard plots in the past year. The Economic Botanist, Bengal, who visited the farm in November last, assisted in doing a certain amount of selection work. On his recommendation 18 types were discarded, and four of what seemed the best types were selected for thorough and final test against *Indra sail* as a standard.

In addition to the above tests the remaining 91 varieties and 28 varieties recently selected and sent in from the districts by the Agricultural Inspectors will be grown as single series for further observation.

This selection work has now reached the stage when its bearing on the agricultural work in the district becomes evident.

From the present time, selected types will be tested in areas outside the farm by the local agricultural officer, and the results obtained by these officers will be utilized in arranging the details of future work.

Indra sail and *George sail* have generally given good results where tried throughout the province.

In the present season each Agricultural Inspector has arranged for the distribution of numerous small lots of five seers each to interested cultivators in his district. The object is to introduce these selections to cultivators over as wide an area as possible.

The seed is being given free on the understanding that a similar quantity will be returned from the produce. Where the introduced kinds prove obviously superior to local paddies, distribution will be pushed forward vigorously in the following year. If, on the other hand, the local kind proves obviously superior a representative sample will be brought to the farm for inclusion in the observation tests of the following year.

There appears to be a difference of opinion among Botanists as to the extent to which it may be possible to improve the productivity of a variety by selecting heavy yielding single plants from that variety.

Intra-variatal selection experiment.

In order that some information might be gained on this point the above experiment was begun in the year 1917. *Lati sail* as one of the heaviest yielding local varieties was selected for the trial, and seedlings were transplanted in $\frac{1}{10}$ th of an acre. At harvest time 100 plants having the same characters as the original variety were selected at random and kept separately. All the well-formed grains of the ears of each single plant were afterwards counted, and the number of grains was found to vary from 232 to 1,140. The seeds of five of the heaviest yielding plants were tested against five of the least productive, each being grown separately and as a pure line type. The result of the trial was that one hundred plants, grown from seed of the plant which produced 1,140 grains, gave a yield of 146 tolas. While one hundred plants grown from the seed of the plant which produced 232 grains gave a yield of 214 tolas.

The result, if somewhat unexpected, is interesting. However the pressure of other work will prevent further trials of the kind from being carried out.

6. The experiments carried out on a small scale included the

Minor experiment. following :—

(1) *Bonemeal as manure for double crop rice land versus no manure.*—This experiment which was begun in 1915 was designed to give some information, firstly, as to whether or not bonemeal-manuring will prove profitable on the Karimganj Farm or similar rice lands, and, secondly, as to the quantity of bonemeal which should be applied.

Bonemeal has been used at three different rates, viz. :—

- (a) At 3 maunds—247 pounds per acre applied in alternate years with no manure in the intervening years.
- (b) At 6 maunds—494 pounds per acre applied in alternate years and no manure in the intervening years.
- (c) At 3 maunds—247 pounds per acre applied yearly.

The first crop of 1915 and the second crop of 1916 were injured by floods and no results were available. The yields, as far as they have been obtained for three years, are shown in tabular form :—

	Yield per acre, in pounds.				
	1915 2nd crop.	1916 1st crop.	1917 Two crops.	1918 Two crops.	Average Annual crop.
1	2	3	4	5	6
Bonemeal 247 pounds per acre in alternate years.	3,336	1,637	4,434	2,612	2,992
No manure	2,788	1,435	4,164	2,300	2,672
Bonemeal 494 pounds per acre in alternate years.	2,962	1,570	4,277	2,142	2,738
No manure	3,013	1,536	4,066	2,250	2,716
Bon-meal 247 pounds per acre yearly.	2,902	1,605	3,812	2,250	2,642
No manure	3,065	1,475	3,353	2,451	2,586

The disturbing effect of the floods in the first two years and again in the present year, makes this experiment of little value. The average yields however indicate that the light application in alternate years will be more satisfactory than the others.

The question as to whether or not any application of bone-meal is likely to yield a profit on soil, such as that of Karimganj Farm, can only be decided by a continuation of the experiment and accordingly similar work is again being carried out.

(2) *Green manuring for rice crop versus no manure.*—This experiment, started in 1915 with cowpea and *Dhaincha*, was continued since with slight modifications. Duplicate plots were treated with ground limestone at 823 pounds per acre in 1916. The same series of plots was again green cropped in 1917 and 1918, and the average yields for the four years were as follows :—

	Pounds per acre.
No manure	1,635
<i>Dhaincha</i> alone	1,994
Cowpea alone	1,669
No manure	1,756
<i>Dhaincha</i> and 823 pounds ground limestone in 1916 ...	2,129
Cowpea and 823 pounds ground limestone in 1916 ...	1,969

Double cropping with jute and paddy.—(2) It is occasionally objected that the spread of jute growing is objectionable from the point of view that it reduces the area available for food crops. A small area was set aside in order to test how far it might be possible to produce, on the same land, a profitable crop of jute, and follow it by a profitable crop of paddy. The jute was manured with 10 maunds=823 pounds ground limestone, 3 maunds=247 pounds bonemeal, 5 maunds=421 pounds Hyacinth ash and 150 maunds=5.5 tons of cattle manure per acre. The seeds of the Habiganj variety of jute Dhaleswari and of the variety Kakaya Bombai were sown on 14th March 1918 and the crop was harvested on 17th August 1918. The Dhaleswari variety was then quite ready but the Kakaya Bombai variety would have required 3 weeks more. Immediately afterwards the land was prepared and *sail* seedlings were transplanted on 27th August 1918. This crop was harvested on 22nd December 1918, Dhaleswari jute gave at the rate of 701 pounds of fibre per acre, Kakaya Bombai at the rate of 1,274 pounds, that is an average of 987 pounds or 12 maunds of fibre per acre. The price realized was Rs. 7-7-0 per maund equal to Rs. 89-4-0 per acre.

The paddy crop averaged 1,774 pounds or 21½ maunds which at Rs. 3 per maund, the price at which the crop was sold, is equal to Rs. 64-8 per acre.

Cowpea does not grow well on the farm, and even on the limestone area the crops are poor. *Dhaincha* has always grown successfully, and is specially good on the plots manured with ground limestone.

The *sail* paddy crop was slightly damaged in parts by the floods of 1916 and 1918, and therefore the above figures are not absolutely comparative. There would, however, seem to be no doubt of the benefit to the succeeding rice crop of a well-grown leguminous crop, as shown by the crop produced on the *Dhaincha* plots. A somewhat similar increase has been obtained from those plots which received ground limestone as an additional dressing in 1916. It would, however, be difficult to estimate how much of the increased yield was due to the green crop, and how much to the limestone. It is only right to say that the cowpea crop has always been a very small one, even on the limestone plots.

(3) *Dacca selected rices against country rices.*—As in previous years Mr. Hector's selected rices, *Indra sail*, *Lambachikan* and *Kandulia*, were tested against a few of the most productive local rices, and in the present year a variety named Nagra obtained from Chiu-ura was included.

The experiment was carried out in two separate series. In the first series 9 varieties were grown in plots of $\frac{1}{10}$ acre each, and the same number of seedlings was transplanted in each plot. In the second series it was arranged that 8 varieties should be tested in duplicate plots of $\frac{1}{10}$ th acre. The seedlings of some of the plots of the second series were slightly injured by floods which may somewhat disturb the comparison.

The following table shows the average results of these tests in pounds per acre :—

	First series, 1917.	Second series, 1917.	First series, 1918.	Second series, 1918.	Average.
1	2	3	4	5	6
Kandulia	2,970	2,440	2,129	1,814	2,338
Lambachikan	3,630	2,640	1,964	1,719	2,496
Lati Sail	2,530	2,200	2,809	2,005	2,423
Toralali	3,080	2,636	2,243	2,510	2,618
George Sail	4,042	2,640	2,580	2,138	2,850
Indra Sail	2,832	3,180	3,107	2,957	2,869
Palam	3,794	...	2,691	2,293	...
Hati Sail	3,390	...	2,862	1,973	...
Nagia ... ..	...	...	3,135	...	...

In order to make as complete a test as possible of the relative merits of the two varieties *George sail* and *Indra sail*, two further sets of trial were laid down. The first test was carried out on a large scale on the previous year's jute area and here the plots were duplicated eight times. The average yield per acre for *George sail* was 2,491 pounds while for *Indra sail* the average yield was 3,354 pounds. In the second test, which was laid down on slightly lower land, standard test plots each containing 196 plants were arranged under similar condition of cultivation, spacing, etc., and each of the two varieties was planted in ten similar plots. If the average yield of *Indra sail* on these plots be represented by 100 then the average for *George sail* is 116. A similar test was carried out with a promising selection from the local variety *Dholmeg*, but in the latter case each variety was planted in five standard plots. Again representing the

yield of *Indra sail* by 100, the yield of the Dholmeg selection was 117. There seems no doubt that *George sail* requires deeper water than *Indra sail* and that given favourable conditions this variety would be hard to beat. Unfortunately the variety as now grown on the farm does not seem to be quite pure; however selections which were made in the past year should ensure a pure supply of seed for the future.

(4) *Specific gravity selection of paddy seed*.—An experiment to test the method of selecting rice seed by specific gravity was carried out in 1917. The paddy seeds were immersed in saturated brine and only those grains which were found to sink were used for seed.

Selected and ordinary unselected seeds were then grown under similar condition in seed bed, and the seedlings transplanted into similar duplicate plots. The seedlings were transplanted singly at a distance of 9" apart.

The average yields obtained were 1,962 pounds per acre from selected seed, and 1,784 pounds from the unselected seed in 1917, and 1,468 from selected and 1,347 from unselected seed in 1918.

(5) *Ground limestone as manure for paddy land*.—This experiment was started in 1917. Ground limestone was applied at 10 maunds—823 pounds per acre immediately before transplanting the *sail* crop of 1917, and in the year 1918 both a transplanted *aus* and a *sail* crop were grown on this area.

In 1917 the average yield from the lime plots was 2,161 pounds per acre, against 1,906 pounds from the unmanured plot, while in the present year the situation has been reversed, as the unmanured plots have given the heavier yields, the average of the two years crops showing almost identical yields of 1,916 and 1,905 pounds per acre from the unmanured and manured plots respectively. It seems clear from the results that such small applications of limestone have no permanent beneficial effect. This rate was arranged so as to be approximately equal to the cost of the standard application of three maunds of bonemeal.

(6) *A combined variety and manurial experiment on jute*.—Two varieties were tested against one another, viz., Kakaya Bombai which is a pure line selected by the Fibre Expert, Bengal, and a variety obtained from the Habiganj district where is known as Dhaleswari.

The average outturn of fibre in pounds per acre for the four past years was as follows:—

	Kakaya Bombai.	Local variety.
1	2	3
Yield per acre in 1915	2,036	1,224
Ditto in 1916	1,734	1,115
Ditto in 1917	1,441	1,301
Ditto in 1918	1,625	1,193
Average for four years	1,709	1,208

It is only fair to note that in the past season two of the country plots had for some reason rather poor germination, but even after due allowance is made, the yields obtained from the Bengal variety leave no doubt of the great superiority of this selection over any of the ordinary varieties.

In the manurial experiment on this crop the plots were arranged in duplicate, the manures used and yields obtained being shown in the accompanying table. Cattle manure was used at 5·5 ton per acre, ground limestone at 823 pounds, bonemeal at 247 pounds and Water Hyacinth ash at 411 pounds.

Series.	Manures used.	Average yield in pounds per acre.
1.	3	3
A	Cattle manure, limestone	1,234
B	Cattle manure, limestone, bonemeal	1,536
C	Cattle manure, bonemeal	1,152
D	Cattle manure, bonemeal, Hyacinth ash	1,683
E	Cattle manure, bonemeal, limestone	1,666
F	Cattle manure, Hyacinth ash, limestone	1,813
G	Cattle manure, Hyacinth ash	1,604
H	Cattle manure	707

One of the duplicate plots in each of C and E had thin germination and only for this, the series would have been an excellent one, as the addition of each individual manure shows an increase except in E where the falling off is no doubt due to this accidental cause.

Bonemeal costs Rs. 3-8 per maund, Hyacinth ash Rs. 2-2 per maund, crushed limestone Re. 1-1-0 per maund, that is Rs. 10-6 each per acre.

The results from a single trial cannot be taken as conclusive but in the above tests each manure has produced a very profitable increase in the crop.

The price realized this year was Rs. 7-7 per maund.

A small area of both varieties of jute was kept for seed, the yield being 946 pounds per acre from the Habiganj variety, as compared with slightly over 300 pounds from the Kakaya Bombay variety.

(7) *Jowar as fodder in the rains.*—Jowar was again tried as a fodder crop for the rains but, owing to the late arrival of the seed and early arrival of the rains, the crop was a total failure.

(8) *Improved varieties of sugarcane from the Jorhat Farm.*—The three varieties B 147, B 376 and striped Mauritius were grown on a small scale.

The farm lands are situated at too low a level for the successful growth of sugarcane on a large scale, but a small area is grown with the object of giving the farm apprentices a knowledge of the cultivation of sugarcane, and of the making of *gur*. In the past season, 15 acre was under this crop, the yield of *gur* was $7\frac{1}{2}$ maunds and the total price realized Rs. 58.

(9) *Trial of late transplanted rices.*—Owing to the risk of flood damage occurring at any time of the paddy growing season, it is advisable to have a few varieties with as great a range of growing period as possible. With this object *Jhoria* from Sylhet and *Gandhi sail* from Bengal have been grown for the past two years. These paddies bear transplanting later in the season than any other *sail* varieties. Seeds were sown in seed beds on 28th August, transplanted into duplicate plots on 25th September, and harvested on 10th January. The yields obtained were 1,914 pounds and 1,660 pounds per acre from *Jhoria* and *Gandhi sail*, respectively.

7. A large area of non-experimental rice was grown during the year. Together with the experimental rice, it covered almost the entire area of the cultivated portion of the farm, the balance

Non-experimental
crops.

being occupied by small areas of sugarcane, and of jute and *dhaincha* which were grown for seed.

The total yield from the rice crop including the experimental *sail* rice was as follows:—

				Approximate area.	Total yield.	Yield per acre.	Average price realized per maund.
1				2	3	4	5
				Acres.	Tons.	Pounds.	Rs. a. p.
Rice (<i>sail and asra</i>)	...	...	...	51.72	46.8	2,028	...
Rice (<i>aus</i>)	...	...	...	5.61	3.38	1,352	...
Total in 1918	...	...	...	57.33	50.18	1,978	3 0 0
Total in 1917	...	...	...	53.3	50.98	2,110	1 4 0
Total in 1916	...	...	...	53.90	25.26	1,051	2 8 0
Total in 1915	...	...	...	52.64	47.98	1,991	2 7 0

Dhaincha was kept for seed on an area of .15 acre, and gave an outturn of 175 pounds, or at the rate of 1,166 pounds per acre.

8. A variety of cold-weather crops was tried in the past *rabi* season. The land was well prepared in October, but the very long and dry cold weather which supervened gave little chance for satisfactory growth. From the experience of the past few years it seems that there is little prospect for successful cultivation of such crops: it is however advisable to cultivate small areas of the principal crops for the purpose of making the farm apprentices acquainted with them.

Potatoes gave a small crop of 3.4 tons per acre, *cheena* gave about 320 pounds and oats 580 pounds per acre, the yield from the other crops, pulses, oil-seeds and cereals, was negligible.

9. No very serious damage was caused to the farm crops, although different insect pests made their appearance at various times.

Insect pests.

The Farm Manager continues to take timely steps to combat any pests of the kind. Hand-picking, catching by light traps and by bag net, were variously resorted to, and the result was that no damage of any consequence was suffered by the farm crops during the year.

In the early stages of the development of the hairy caterpillar the grubs are found clustered together on the leaves of the affected plants. At this stage much damage can be avoided by picking off all leaves bearing clusters of caterpillars and killing the caterpillars in hot water or a little kerosine oil. This method has been very successfully carried out with the jute crop on the farm during the last few years.

The rice bug (*Leptocoris varicornis*) is the cause of immense damage to the rice crop each year, and particularly to the early varieties. The most effective method of checking the ravages of this insect is to prepare a light cloth about 15 feet long and 4 feet wide. Two boys use this by standing at opposite ends of the cloth, and with a corner in each hand they allow the middle to fall, and bring up the sides until they are about 18 inches apart. One side of the bag net so formed is allowed to sweep along the top of the affected crop, while the workers run quickly across and across the plot. At each end the bag net is closed and twisted to destroy the many bugs which are captured in this way.

The stem borer moth is attracted by any light during the night time and can be easily destroyed on this account. If an ordinary hurricane lamp is suspended over a barrel or tub of water, which has been covered with light film of kerosine oil, the moths will flutter in large number round the lamp and most of them will ultimately fall into the water and be killed by the kerosine. Where no large vessel is available, a small raised pond could be made with mud banks, filled with water and covered with a spoonful of kerosine, and a torch placed over it would provide sufficient attraction.

10. The receipts during the period amounted only to Rs. 564-1-3. Seeds were supplied free for demonstration purposes to the value of Rs. 304-8. The value of paddy and other produce in hands on the 31st March 1919 and since sold was Rs. 3,440-1-0. This gives a total of Rs. 4,308-10-3 from which must be deducted Rs. 168-4-9, the value of paddy, etc., in hand at the beginning of the period. The net result is that produce to the value of Rs. 4,140-5-6 was produced during the season 1918-19.

Receipts and expenditure.

This very satisfactory result was in large measure due to the higher prices prevailing for paddy but a very considerable share of credit is also due to the Farm Manager for the well-thought out arrangements by which he was able to obviate any very serious flood damage. By growing seedlings of deeper water paddies, by keeping reserve seedlings of several varieties in hand, by promptly replanting some of the damaged areas, and filling in others, almost a 16-anna crop was obtained over the whole cultivated area of the farm. This compares very favourably with the eight-anna crop or less, which was the average on areas outside the farm.

The total expenditure for the nine months was Rs. 7,182-2-7 which compares with Rs. 7,453-8-10 in the previous year. It was distributed as follows :—

			1918-1919.		
			Rs.	a.	p.
Establishment	...	...	2,131	2	2
Petty construction, including fencing, roads, bridges, etc.	...	...	1,453	7	6
Purchase of machinery	...	...	8	0	0
Purchase of cattle	...	...	135	0	0
Feed of cattle	...	...	494	9	7
Seeds, plants and manures	...	...	27	6	9
Wages of labourers	...	...	1,731	2	5
Petty repairs	...	...	642	15	1
Purchase and repair of furniture...	...	...	80	0	0
Books, maps and periodicals	...	...	31	1	0
Service postage stamps and telegrams	...	...	25	0	0
Cost of land	...	...	85	9	7
Unspecified charges . .	...	...	336	12	6
Total	...	...	7,182	2	7

Owing to various causes the expenditure is proportionately heavier than in the previous year. The expenditure under "Petty construction" has increased owing to costs incurred in burning one lakh of bricks which are to be used in the coming year for new buildings. Four old bullocks were sold and four purchased to replace them, which is responsible for an increase under the head "Purchase of cattle." A breeding bull was maintained at the Farm in addition to the usual number of working stock, and as prices of food stuff have gone up, a

considerably increased expenditure was necessary for "Feed of cattle." A sum of Rs. 85-9-7 was spent in the purchase of a small piece of land to enable improvements to be made in the drainage of the farm. Further sums were spent in raising an earthen bund round the experimental area which should keep the rice selection work safe unless record breaking floods occur. A site has been raised for cattle sheds which has still further increased the expenditure on earthwork. The extra expenditure incurred under these various heads amounts to upwards of Rs. 1,600.

Staff. 11. The sanctioned establishment of the farm consists of :—

			Rs.
1 Farm Manager	...	...	100—5—200
1 Assistant Farm Manager	...	...	25—1-8—40
			<i>Plus Rs. 10 Local allowance.</i>
1 Farm clerk	...	...	25—1-8—40
1 Peon	...	...	8 0 0

In addition, arrangements are made for the entertainment of six apprentices to be trained for eventual employment as Agricultural Demonstrators. The period of training extends to 2 years.

The first apprentice trained at the farm was appointed as Demonstrator in August 1915 ; he served in that capacity until 1917 when he was appointed Assistant Farm Manager. During the year 1916-17 three, during 1917-18 two, and during the present period two young men completed their training. With the exception of one young man who suffered from ill-health and was unable to take up work, all these men have been appointed as Demonstrators and most of them are working satisfactorily. Two Demonstrators were required to help in demonstration work, and they were sent out to the districts towards the end of the period. The vacancies have been filled up by the appointment of two Muhammadans, which gives two Hindu and four Muhammadan apprentices. The scheme of giving a preliminary training to young men of the Bhadralog class intended for scholarships at Sabour is to be continued during the coming year if suitable men offer. These young men, who are given an opportunity of qualifying for posts as Agricultural Inspectors, are trained in practical agriculture for one year before proceeding to Sabour.

Babu Surendra Nath Gupta, Farm Manager, Babu Girindra Kumar Dc, Assistant Farm Manager, and Babu Jatindra Chandra Dutta, Farm Clerk, remained in charge of their respective posts throughout the period.

CAMP KARIMGANJ, }
The 3rd May 1919. }

J. W. MCKAY,
Deputy Director of Agriculture,
Surma Valley and Hill Districts,

REPORT OF THE KAMRUP SUGARCANE EXPERIMENT STATION FOR 9 MONTHS ENDING THE 31st MARCH 1919.

1. *Introductory.*—The objects and scope of this experiment were described in paragraph 1 of the annual report of the Kamrup experiment station for the year ending 30th June 1914. As explained therein, it was proposed to reclaim an area of about a thousand acres of land for sugarcane cultivation, but up to the present it has been found possible to open out and keep under cultivation only about 800 acres, and without the aid of additional cultivating machinery, such as motor tractors with suitable implements, it is extremely doubtful whether the present area is capable of extension. The steam cultivating tackle is excellent for breaking up new land and preparing it for cane, but for other crops in the rotation some auxiliary implements are required for working up the finer tilth required for small seeds, and also for the ploughing in of green manure crops. Probably the addition of a disc plough and disc harrow to the steam tackle would go a long way to supply the deficiency, but owing to the fact that the work of planting cane and also the cultivation of land coming out of cane comes together with a rush in the spring, extra power in the form of motor tractors is required in order to get the spring cultivation done in due season, and also to enable us to get the full value of the existing steam tackle in extending the area under cultivation. This was recognised some time ago, and enquiries have been made with regard to motor tractors and also extra implements, but, owing to the war, financial considerations have hitherto prevented any action being taken. It is hoped that now the war is over and the conditions with regard to the import of machinery are improving, these deficiencies will be made good.

No new land was opened up during the year under report, so the total area under cultivation remains the same as stated in last year's report, *viz.*, 817 acres. Of this, 493 acres were under sugarcane—plant cane 230 acres and ratoon cane 263 acres, and the remainder under other crops.

Last year's report dealt with the crop harvested in the spring of 1918, and also up to June 30th, 1918 with the progress of the young crop planted in 1918. The present report carries on

up to 31st March 1919 only, the date for the submission of the annual reports of the Agricultural Department having been changed recently by Government, and deals with the subsequent development of the crop harvested in the spring of 1919, and the preparation of the land for and the planting of the new crop now on the ground.

2. *Land and communications.*—The site of the experiment is situated in North Kamrup under the Bhutan Hills about 17 miles by road north of Nalbari station, Eastern Bengal Railway, and lies between the new and old Pagladiya rivers and near the village of Topolia. The farm is approached from Nalbari station by a public road northward to Garbhitar village, some 10 miles, where a village track leading to Khagrabarigaon has been widened out and made into a cart road and extended to the present farm site which is 7 miles from Garbhitar. The greater portion of this tract consists of high land carrying tall grass jungle, with occasional swamps which are, however, capable of drainage, the fall from the hills to the south being from 15 to 20 feet per mile.

3. *Rainfall.*—Farm records have been kept since January 1915. The following table shows the figures for the year under report with monthly averages to date :—

Month.				Inches.	Average inches to date since January 1915.
1				2	3
April	1918	...	...	4.80	5.89 (average of 4 years).
May	"	...	...	9.25	15.58 "
June	"	...	...	25.23	18.97 "
July	"	...	...	31.65	24.8 "
August	"	...	...	19.38	17.44 "
September	"	...	...	10.01	8.79 "
October	"	...	...	0.39	5.57 "
November	"	...	...	0.93	0.28 "
December	"	...	...	Nil	0.06 "
January	1919	...	...	Nil	0.15 (average of 5 years).
February	"	...	...	0.26	1.53 "
March	"	...	...	Nil	2.85 "
Total				101.84	171.44

The main feature of the season was the extraordinary dryness of the weather in October, and the long drought which commenced early in November and lasted until the end of the year under report. October had only one shower giving less than $\frac{1}{2}$ inch of rain against an average of $5\frac{1}{2}$ inches, while, with the exception of one slight shower in the middle of February, the usual spring rains failed us entirely. This drought, while facilitating the preparation of the land for the crop to be planted in the spring, was detrimental to the standing cane crop, which apparently ceased to grow early in October and was thus somewhat stunted especially in the latter planted areas. It also retarded the germination of the new crop of cane in the spring, but its full effect in this respect cannot be determined until later.

Seventy-six inches, *i.e.*, about 75 per cent. of the total rainfall, fell during the months June to August inclusive, and this long period of wet weather put a complete stop to cultural operations with the steam tackle, with the result that only on a small portion of the area sown with green manure crops could the crops be ploughed in.

4. *Soil*.—The following report on some samples of soils examined has been received from Mr. A. A. Meggitt, Agricultural Chemist, Assam :—

KAMRUP FARM SOILS.

	Lab. No. 22.	Lab. No. 23.	Lab. No. 24.	Lab. No. 25.
	Block I. 0-9".	Block I. 9-15".	Block II. 0-9".	Block IV. 0-9".
1	2	3	4	5
A. Soluble in 26 per cent. Hydrochloric Acid with 48 hours' digestion at 100° C.	Per cent.	Per cent.	Per cent.	Per cent.
Phosphoric Acid ($P_2 O_5$)	0.079	0.065	0.074	0.064
Potash ($K_2 O$)	0.817	0.938	0.873	0.632
Lime ($Ca O$)	0.273	0.210	0.163	0.196
Magnesia ($Mg O$)	0.864	0.955	0.860	0.739

KAMRUP FARM SOILS—*concl.*

	Lab. No. 22.	Lab. No. 23.	Lab. No. 24.	Lab. No. 26.
	Block I. 0-9".	Block I. 9-15".	Block II. 0-9".	Block IV. 0-9".
1	2	3	4	5
B. Available, i. e., soluble in 1 per cent. Citric Acid with 7 days' digestion, Dyer's method.	Per cent.	Per cent.	Per cent.	Per cent.
Phosphoric Acid	0.022	0.019	0.030	0.023
Potash	0.009	0.006	0.013	0.009
C. Moisture in air-dry soil	1.41	1.34	1.41	1.00
Loss on ignition (Organic matter and combined water).	4.62	3.08	4.79	3.33
Nitrogen	0.112	0.077	0.119	0.091
Humus	1.70	1.50	1.90	1.60
Reaction	Acid ...	Very slightly alkaline.	Acid ...	Acid
Lime (CaO) requirement per 19 million of air-dry soil, in lbs., by Veiteli's test.	430	nil	400	350
Carbonate of lime	0.017%	0.015%	0.012%	0.015%

"Results are expressed as percentages on air-dry samples.

* *Notes.*—These soils present a striking similarity. Reserve Phosphoric Acid is on the weak side while the available amounts of that element of plants food are good.

Total Potash is high, more than would be expected in this class of soil at first sight. Available Potash is on the weak side in all except No. 24. Lime will probably bring the reserves into use.

Lime is low and Magnesia high.

Three out of four samples are acid in reaction.

Having regard to the low lime and high magnesia content, as also to the small amount of carbonates present, to the existing state of combination of the humus and to the reaction, I am of opinion that the primary requirement of these soils is lime, using preferably ground limestone. I anticipate a 25 per cent. increase in the cane crops as a result as a minimum.

Nitrogenous manuring for a crop like cane will be necessary and phosphatic manuring will have to be resorted to ere long."

5. *Buildings, etc.*—The buildings consist of the Manager's bungalow, staff quarters, office with dispensary, coolie lines, cattle shed, godown, smithy, etc. At present all these are of a temporary type except the Manager's bungalow. It is proposed to erect a more substantial godown with a pucca floor during the coming year.

A temporary laboratory was erected near the factory during the year at a cost of Rs. 633-13, and eight new coolie huts were added to the lines.

No new fencing was purchased, the cultivated area being already enclosed by $4\frac{1}{2}$ miles of wire fencing. This excludes pig and deer but not bears, which have caused a good deal of damage in former years. This year, however, the bears were kept in check by armed choudkars, and in consequence the damage to the cane was much less than usual.

6. *Cattle.*—There are 73 bullocks on the farm at present, of which 23 belong to Government and 50 to the factory. Of the 83 heads mentioned in the last year's report, 6 died during the year (one Government and 5 factory), 10 factory bullocks were taken over by the factory, and Government purchased 3 pairs locally at a cost of Rs. 160 per pair.

7. *Water-supply.*—Norton tube wells are used with great success, and an excellent supply of drinking water is available all the year round. These wells, distributed over the cane area, provide water also for the engines. In addition, a permanent running stream close by the coolie lines supplies water for washing purposes, etc.

8. *Labour.*—As in previous years, labour was recruited from Ranchi personally by the Manager with the sanction of the Government of Bihar and Orissa. For the last two years recruiting has been done on a 12 months' basis instead of 6 months. The system works excellently, and a certain number of coolies have settled down here. As a rule this imported labour force keeps very good health, but in October 1918 the prevailing influenza epidemic swept through this tract of country causing a severe outbreak on the farm which resulted in 45 deaths.

In addition to the imported labour a number of Kacharis from villages near by and a few Nepalis also work on the farm.

At the end of the year the total imported labour force amounted to 103 men, 19 women and 81 children. The local labour is very casual and fluctuates widely, but at the end of the year, which is a very busy season on the farm, the numbers actually employed were 125 men, 109 women and 35 children.

9. *Cultivating tackle*.—This comprises:—

- 2 steam tractors, Fowler's compound engines;
- 1 five-furrow double ended plough;
- 1 harrow;
- 1 cultivator;
- 1 roller;
- 1 ridger;
- 1 leveller;
- 1 ditcher;
- 1 motor plough, Fowler-Wyllie.

The steam tackle has continued to work satisfactorily, and is in good condition considering that it has been worked continuously as far as weather permitted since January 1915.

One steel cable 600 yards long was purchased during the year at a cost of Rs. 1,690. No other spare parts were obtainable in India, and could not be imported owing to war conditions.

The Fowler-Wyllie motor plough has been found unsuitable for our purpose, as, owing to its narrow wheel base, it has a tendency to topple over on any land without an even surface.

In view of what has been written in paragraph 1 of this report the question of the provision of extra power implements and spare parts requires serious consideration at once, otherwise it will be extremely difficult if not impossible to carry out our future programme.

10. *Drainage*.—The system of drainage adopted in 1916 and described in paragraph 11 of the report for that year has worked satisfactorily, and no new main channels had to be cut during

the year under report. The water table has been considerably lowered, and the heaviest falls of rain are rapidly carried away. Evidence of the good effect of the drainage scheme is apparent in the fact that about 10 acres of low land in block No. 2, which until last year was only suitable for wet rice cultivation, has now become too dry for rice and has been planted for the first time with sugarcane this year.

11. *Sugarcane crop of 1918-19.*—This comprised 263 acres of ratoons of the plant cane crop of season 1917-18, the results of which were recorded in last year's report, and 230 acres of plant cane which, as reported last year, was planted in the spring of 1918.

The crop was distributed as follows :—

Ratoon, acres.		Plant cane, acres.	
Block No.	5—20	Block No.	11—48
"	6—50	"	12—16
"	7—30	"	13—60
"	8—60	"	15—25
"	9—55	"	16—15
"	10—48	"	17—54
		"	18—12
Total	... 263	Total	... 230

The ratoon crop again suffered severely from the fact that the previous plant cane crop was taken off very late in the spring of 1918. This was unavoidable owing to the factory not being ready to commence work until the beginning of March, and when it did start it worked only intermittently until April 1st. In the meantime the cane was kept on the ground waiting for the factory to start again, but when it was realised that there was no hope of this the cane was cut and thrown away as rapidly as possible. Harvesting however was not completed until the beginning of May, and actually it was not possible to remove some of the cane from the fields until the end of May. Consequently the bulk of the ratoon crop got a very late start, and in some blocks cultivation was not possible before June. After harvesting the plant cane crop the trash on the fields was burnt

as far as possible. During the growing season the crop was hoed 3 to 4 times and hand-weeded 4 to 5 times. The cane was "stripped" in September-October. No other cultivation was given and no manure was applied.

Harvesting commenced on December 28th when the factory required cane for trial, and more than half of the ratoon crop was harvested in January and supplied to the factory. Of the remainder some had to be thrown away and some was still standing at the end of the year in the hope that the factory would eventually be in a position to deal with it.

The plant cane of 1918-19 is mentioned briefly in paragraph 13 of last year's report, as having been planted from the latter end of January 1918 to April 1918. The whole area was new land planted with cane for the first time, but about 108 acres in blocks No. 11 and 13 had been reclaimed the previous year, while the remainder was reclaimed just previous to planting. It has been found that opening up land a year in advance of planting has a very beneficial effect on the subsequent crop as will be seen from the figures given in paragraph 12 of this report. This crop received the same cultivation as the ratoons, and similarly no manure was applied. Germination was on the whole good, and the young cane got a good start especially on the earlier planted areas. Blocks No. 17 and 18, having been planted late owing to unavoidable circumstances, were consequently much more backward than the remainder of the area. The effect of the season on the subsequent growth of the cane is referred to in paragraph 3. The cane, which in September gave every promise of a bumper crop, was undoubtedly adversely affected by the exceptionally early stoppage of rainfall, with the result that the outturn fell short of what was expected.

Harvesting commenced on 28th January and was completed on April 1st. Owing however to frequent breakdowns in the factory and in view of the fact that even when actually in action it was working up to only about half its estimated capacity and could not possibly deal with the whole of the crop, it was decided to go on harvesting the cane whether the factory could take it or not in order to give the young ratoon crop a chance. Consequently a large proportion of the plant cane crop had to be thrown away.

It is a regrettable fact that, owing to the unsatisfactory condition of the factory, we have again to record the loss of the

greater part of our crop. The actual amount of cane taken by the factory up to 31st March was 1,572 tons; since then up to the time of writing (April 27th) an additional 283 tons has been taken, making a total of 1,855 tons, of which 1,075 tons were plant cane and 780 tons ratoon. There is still about 25 acres of ratoon cane left standing in the field, but it is extremely doubtful whether the factory will be able to deal with it, as the fine weather has broken and showery weather has set in.

The total number of days on which cane was supplied to the factory since 28th December up to date is 58, but this does not accurately represent the number of days that the factory was actually working, as on some days that cane was supplied the factory did not work, while on some days when cane was not supplied the factory was working off accumulations.

12. *Outturn of cane.*—Owing to the irregular demand of the factory for cane and the fact that large quantities of cane had to be thrown away, as explained in the last paragraph, accurate weighments of the whole of the crop were impossible. In the case of the ratoon it was possible to weigh the greater part of the crop, but in the case of the plant cane, with one exception, a representative area (usually one acre) only was weighed in each block. The following tables show the results as far as they could be ascertained under the circumstances:—

RATOON CANE.

Block No.	Variety.	Area of Block.	Area weighed.	Weight of cane stripped for milling.	Calculated weight of cane per block.	Weight of cane per acre.	Remarks.
1	2	3	4	5	6	7	8
		Acres.	Acres.	Tons.	Tons.	Tons.	
5	B. 147	20	20	45½	...	2.3	Remaining 30 acres was cut and thrown away.
6	Mixed	50	20	81	200	4	
7	Striped Mauritian.	30	30	73	...	2.4	
8	Striped Mauritian.	60	60	136.5	...	3.1	
9	B. 147	56	30	170	313	5.7	The remainder of this cane is still standing. From the 30 acres weighed top sales have about 15 acres were taken.
10	B. 376	48	48	231	...	4.8	
	Total	363					

PLANT CANE.

Block No.	Variety.	Area of block.	Area weighed.	Calculated weight of cane per block.	Weight of cane per acre.	Remarks.
1	2	3	4	5	6	7
		Acres.	Acres.	Tons.	Tons.	
11	B. 376	48	1	1,176	24.5	Rather more than $\frac{1}{2}$ of this was milled and remainder thrown away.
12	B. 376	16	1	377	23.6	Only 20 tons of this was milled. Remainder thrown away.
13	B. 147	60	3	1,578	26.3	Top setts taken from 15 acres for planting, 165 tons cane milled, remainder thrown away.
15	B. 376	25	nil	222	8.9*	Top halves of canes were used for planting, bottom halves were thrown away, as factory was not working.
16	B. 376	16	15	134 actual.	8.9	This field was accidentally burnt before harvesting. The whole of the cane was milled.
17	Striped Mauritius.	34	2	626	11.6	Top setts from 15 acres used for planting, 368 tons cane supplied to factory, remainder thrown away.
18	Striped Mauritius.	12	1	198	16.7	Of this 27 tons supplied to factory. Remainder thrown away after top setts were taken for distribution.
	Total	230		4,241		

* The yield has been taken as equal to that of the adjacent Block No. 16 to which it was very similar.

According to the above actual weighments and estimates 263 acres of ratoon cane yielded only 1,050 tons, or at the average rate of almost exactly 4 tons per acre. It is needless to remark that a crop like this is practically useless and would not pay for the cost of cultivation, but it has already been noted in the preceding paragraph that this crop never had a fair chance. It is hopeless to expect to get a good ratoon crop unless the previous plant cane crop is taken off before the end of March. Also there is not the least doubt that ratoons require manuring, coming as they do immediately after a heavy crop of plant cane, which is a heavy tax on the soil.

The plant cane gave a total estimated crop of 4,241 tons on 230 acres, or an average of 18.4 tons per acre. This is disappointing in view of the excellent growth that the cane made during the earlier part of the season. It will be noted that blocks 13 and 11 which were cultivated a year in advance of planting gave 26.3 and 24.5 tons per acre respectively, while block 12 gave a very fair crop also. The remainder of the crop

was poor. Blocks 15 and 16 are low, and the crop undoubtedly suffered from the fact that the soil had not been sufficiently weathered before planting. The comparatively poor crops on blocks 17 and 18 can be explained by the fact that they were planted very late on newly-broken up jungle land.

13. *Quality of cane.*—I am indebted to Mr. A. A. Magait, Agricultural Chemist, Assam, for the following report. The analytical work was done by an Assistant under his general supervision.

"No analytical work was possible before the middle of January 1919, as the laboratory was not completed in time. Factory work commenced about mid January and continued intermittently until the end of April.

"The same scheme of analytical control as was adopted last year was again carried out. The scheme is tortuous and in some respects unsatisfactory, but with the existing Factory arrangements no other was possible.

"The average results for the whole season were as follows:—

			Per cent.
Expression : Juice on Cane ...	...	...	61.1
Sucrose in juice ...	...	...	17.09
" Bagasse ...	...	...	7.66
Purity co-efficient of juice ...	...	...	87.2
Fibre in cane ...	...	...	13.65
Sucrose in cane ...	...	...	13.42

The sucrose in cane thus works out at only 78.5 per cent. of the sucrose content of the juice, a figure which is certainly below the truth.

The other figures given in the following table are averages for each variety abstracted from the factory records. In most cases they represent a very considerable quantity of cane, varying from approximately 60 or 70 tons up to as much as 300 tons. It is not desired to lay too much stress on these figures, as on many occasions the cane lay about the factory yard for some day before being milled, and would not be improved as a consequence."

SEASON 1918-19.

Variety.	Date of milling.	Sucrose in juice, per cent.	Sucrose in bagasse, per cent.	Purity on effi- cient of juice, per cent.	Flux in cane, per cent.	Sucrose in cane, per cent.	Remarks.
1	2	3	4	5	6	7	8
B. 376 Plant Cane	Mid.-March	18.14	8.72	98.9	14.2	14.48	
B. 376 Ratoons	Mid.-January	16.99	6.97	87.4	11.9	13.09	
Striped Mauritius plant cane.	End-March	19.75	9.38	92.1	14.25	15.71	
Striped Mauritius ratoons	Mid.-January	17.40	8.31	86.0	...	13.87	Cane lay at factory 7 days before milling.
B. 147 plant cane	Mid.-February	16.84	5.62	84.9	15.03	12.17	Cane unripe.
B. 147 ratoons	End-April	16.88	7.82	87.2	14.51	13.86	

14. *Cane nursery*.—It is recorded in last year's report that 15 new varieties of cane were planted in a nursery in the spring of 1918. These varieties were B. 208, B. 6450, B. 3, 12, Barbadoes A and B (number uncertain), Java 33a, W. M. Nos. 1, 2, 3 and 4, Tanna, Bombai, Kamrup red sport of Striped Mauritius, Red Java and Green Java. All these made good growth except W. M. No. 1 and Barbadoes B., and, with the exception of these two varieties, all the material from the nursery has been planted out in Block No. 14 this season for a preliminary trial in field.

The following table gives some analyses of these canes :—

NURSERY CANES, 1918-19 PLANT CANE.

Variety.	Date of milling.	Juice extraction, per cent.	Sucrose in juice, per cent.	Sucrose in bagasse, per cent.	Purity co-ef- ficient of juice, per cent.	Sucrose in cane, per cent.	Remarks.
1	2	3	4	5	6	7	8
B. 3412 ...	17th January 1919 ...	73.8	12.50	4.68	79.9	10.45	All these varieties were harvested 10 to 11 months after planting and before they were ripe with the object of discovering early ripening varieties. It will be seen that B. 208, Red Java, Red Mauritius, B. 6450 were very good at this time, while White Bombai, J. 33a and White Mauritius No. 3 were all good enough to mill.
White Bombai ...	17th " " ...	76.5	14.84	5.81	85.6	12.72	
Red Java ...	18th " " ...	75.6	16.71	7.64	85.4	14.50	
Tana ...	18th " " ...	70.8	12.71	4.35	78.9	10.27	
B. 208 ...	18th " " ...	75.1	19.63	8.66	94.2	16.90	
Barbadoes A. ...	20th " " ...	73.8	13.18	3.93	80.4	10.80	
White Mauritius No. 2 ...	21st " " ...	70.3	12.75	4.47	79.3	10.29	
White Mauritius No. 3 ...	22nd " " ...	63.5	16.28	5.91	89.2	12.50	
Red Mauritius ...	23rd " " ...	72.4	16.82	7.30	92.7	14.20	
White Mauritius No. 4 ...	24th " " ...	73.2	13.56	5.00	83.9	11.20	
B. 6450 ...	25th " " ...	74.7	16.33	4.73	88.7	13.40	
J. 33a ...	27th " " ...	68.0	15.42	6.63	86.6	12.60	

15. *Planting of the present crop.*—Planting commenced at the beginning of January when the nursery cane was planted out in Block No. 14, and was finished in the middle of March. The following table shows the areas planted, the varieties and the time of planting, etc :—

Block No.	Area, acres.	Variety of cane.	Date of planting.	Remarks.
1	2	3	4	5
14	39 4	Nursery varieties B. 376.	January 2nd to 20th.	Land broken up in 1917. <i>Dhaincha</i> for seed grown in 1918. Planting done on good moisture.
3	60	Striped Mauritius.	21st January to 3rd February.	Land first broken up in autumn, 1915. Plant cane, 1916. Ratoo cane, 1917. <i>Dhaincha</i> for green manure, 1918.
5 half-block.	30	B. 147 ...	14th to 18th February.	Land first broken up at end of 1915. Plant cane, 1916. Ratoo, 1917. Fallow during 1918.
2	55	B. 147 ...	4th to 14th February.	First broken up Spring, 1915. Ten acres were under paddy in 1916 to 1918. Ten acres (2.5, 1915, ratoo, 1916, in 1917, fallow, 1918. Remainder under sunnery crops in 1915, plant cane 1916 and ratoo 1917. Fallow, 1918, except 5 acres which carried <i>Jowar</i> .
1	90	B. 376 ...	1st to 15th March.	First broken up January 1915. Plant cane, 1915, Ratoo, 1916, 2nd ratoo 1917. Cowpea rains, mustard rabi, 1918.
Total ...	239			

No manure was applied at the time of planting, but it is proposed to give a top dressing of 20 maunds rape cake per acre to Blocks 1, 2 and 5, and 15 maunds per acre to Block 3. This will be hoed into the land during the coming growing season.

With the exception of a portion of Block No. 2, moisture was fairly good in all blocks at the time of planting, but germination has been considerably retarded by the exceptionally dry spring. This year as last year reserve nurseries have been planted along the roadsides for filling vacancies.

The plant cane crop of 1918 is being ratooned this year, thus the total area under cane in 1919 is 469 acres, of which 239 acres is plant cane and 230 acres ratooned.

16. *Other crops.*—*Dhaincha* (*sesbanea aculeata*) for seed was sown on part of Block No. 14, and a yield of 70 maunds of seed was obtained from about 20 acres. *Jowar* (*Sorghum vulgare*) yielded 40 maunds of seed on 5 acres of Block 2.

Green manure crops.—Cowpeas for green manure were sown on Blocks Nos. 1 and 4. The growth was very uneven, but there was a fairly good crop on the whole. Owing to the extremely wet season, however, the crop could not be ploughed in and rotted on the field. Although the full effect of this crop as green manure was not obtained, still the crop was by no means altogether wasted, as the rotting vegetation was ploughed in subsequently.

Dhaincha for green manure was sown on Block No. 3, giving a very luxuriant crop. Unfortunately owing to weather conditions only half could be ploughed in, the rest being burnt off at the end of the rains.

The problem of getting green manure crops ploughed in is extremely difficult at present. This is to a great extent due to the lack of suitable implements. This year we are trying sowing *dhaincha* earlier in the hope that some of it at least will be fit for ploughing in before the break of the monsoon.

Rabi crops.—Mustard was sown on Block No. 1, but, owing to bad tilth and short rainfall, germination was poor and only 7½ maunds of seed was obtained from the 60 acres. On Block No. 2 *marikalai* was sown on 20 acres and cowpea for seed on 10 acres, but germination was so poor that they were ploughed up.

17. *Spring sowings, 1919.*—Land not under sugarcane in 1919 is being cropped during the rains as follows.—Blocks 4, 6, 7, 8, 9 and 10 *dhaincha* for green manure; Block 5 northern half 25 acres *dhaincha* for seed and 5 acres Finlow's selected jute for seed.

Thirty acres of Block 4 have been given a dressing of 32 maunds crushed limestone per acre before sowing the *dhaincha*, in preparation for future manurial experiments.

18. *Expenditure.*—This is shown in the following statement. Expenditure from April 1st to June 30th, 1918, has already been given in last year's report, but, in order to make the statement complete for the financial year 1918-19, it is included again in a separate column.

Heads.	From 1st April 1918 to 30th June 1918.	From 1st July 1918 to 31st March 1919.	Total.
1	2	3	4
<i>Establishment.</i>	Rs. a. p.	Rs. a. p.	Rs. a. p.
Manager ...	3,000 0 0	9,000 0 0	12,000 0 0
Clerks ...	225 0 0	675 0 0	900 0 0
Compounder ...	90 0 0	270 0 0	360 0 0
Peons ...	90 0 0	270 0 0	360 0 0
Tackle Assistants ...	547 0 0	1,702 3 0	2,249 3 0
Muharrirs ..	13 0 0	385 0 0	520 0 0
Sugar Analyst ...	100 0 0	270 15 6	370 15 6
Additional establishment...	...	20 0 0	20 0 0
Total ...	4,187 0 0	12,593 2 6	16,780 2 6
<i>Special Contingencies.</i>			
Impl-ments, machinery, etc. ...	51 0 0	3,376 0 0	3,427 0 0
Buildings ...	...	820 1 0	820 1 0
Fencing ...	1,555 8 0	...	1,555 8 0
Total ...	1,606 8 0	4,196 1 0	5,802 9 0
<i>Regular Contingencies.</i>			
Wages of labourers ...	11,732 12 3	37,694 8 3	49,427 4 6
Feed and purchase of cattle ...	...	3,98 7 0	3,998 7 0
Seeds, plants and manure ...	8 7 0	1,540 3 0	1,648 10 0
Petty repairs... ..	66 0 0	1,178 13 0	1,244 13 0
Unspecified charges ...	277 8 6	4,788 9 3	5,066 1 9
Fuel ...	500 14 0	5,898 1 0	6,398 15 0
Stores, oil, etc. ...	...	997 15 0	997 15 0
Total ...	12,585 9 9	56,196 8 6	68,782 2 3
Grand total ...	18,379 1 9	72,985 12 0	91,364 13 9

Under the head "Unspecified charges" is included a sum of Rs. 4,065-3-9 paid to the Factory owner on account of transport of machinery, etc., and repair of a boiler.

With regard to receipts, it is impossible to give the figures at present, as milling has not yet been finished and accounts have not been settled with the factory. The price we get for the cane supplied depends upon its sugar content and the average price obtained for the sugar, and until the sugar has been sold it is impossible to effect a settlement.

The actual amount credited to the treasury during the year was Rs. 25-10, being the balance of the price of sugarcane

cuttings sold in 1918. This year the farm supplied 255,500 sugar-cane setts, some of which were sold at annas 8 per hundred to cultivators, and some were used for demonstration purposes.

The value of these setts was Rs. 1,277.

19. *Staff*.—The staff during the year consisted of—

			Rs.	
	Manager on	...	1,000	per mensem.
	Clerk on	...	75	"
Engine staff	{ One mistry on	...	55	"
	{ Two Engine drivers on	...	22	"
	{ Three 2nd Engine drivers on	...	18	"
	{ Two Engine attendants on	...	15	"
	{ One godown muharrir on	...	20	"
	One muharrir	...	25	"
	One compounder on	...	30	"
	Three peons on	...	10	"

From November 1918 an extra fitter on Rs. 35 per mensem was been employed on the steam tackle.

From April 1st, 1919, Srijut Sarbananda Sarma, who has held the post of clerk for the last four years, was appointed Assistant manager on Rs. 100 a month, and another clerk was appointed on Rs. 50 a month in his place.

20. *General*.—The Hon'ble the Chief Commissioner, the Chief Secretary and the Deputy Commissioner, Kamrup, visited the farm in December 1918.

The Director of Land Records and Agriculture, the Deputy Director of Agriculture and the Agricultural Chemist inspected the farm frequently throughout the year.

In August 1918 the Assam Administration entered into a new agreement with the Mill owner to grow cane under certain conditions for the factory until 31st March 1924. Since then a company, Assam Sugar Estates and Factories, Limited, has been formed, with Messrs. Bird and Company of Calcutta as Managing Agents, to take over the concern from Mr. Maxwell, formerly the Mill owner.

Since the close of the year (March 31st), the farm has been visited by a very destructive beetle belonging to the Dynastines family previously unknown as a pest on sugarcane. This beetle was first noticed at the end of the first week of April, and is now found on all parts of the farm. It attacks both plant and ratoon cane working entirely underground, and eats through the young shoots at the base. It is also found boring in the setts of

plant cane and in the stumps of ratoon cane. No remedy yet been discovered. The damage at present cannot be estimated as all the cane has not germinated yet, also it is hoped that lering will take place below the points attacked, and that a crop of young shoots will come up.

KAMRUP FARM, }
The 27th April 1919. }

A. G. BIRT,
Deputy Director of Agriculture
Assam Valley

REPORT ON AGRICULTURAL DEMONSTRATIONS,
IN THE ASSAM VALLEY CIRCLE, INCLUDING
THE GARO HILLS AND SADIYA FRONTIER TRACT,
FOR NINE MONTHS ENDING THE 31st MARCH
1919.

In accordance with Government orders changing the termination of the Agricultural year from 30th June to 31st March, this report deals with the period of nine months from 1st July 1918 to 31st March 1919.

2. *Staff*.—During the period under report the demonstration staff in the Assam Valley was reinforced by the appointment of an Agricultural Inspector and two demonstrators to the Lakhimpur and Goalpara districts. With these additions the staff in the Valley now consists of one Superintendent, five Inspectors and twelve demonstrators. Only one district, namely, Darrang, now remains without any Agricultural staff, and, with the posting of an Inspector to this district and possibly the appointment of an extra Inspector as leave reserve, the superior staff for demonstration work in the Valley will be complete. The staff of demonstrators who assist the Inspectors is still very weak, but is being gradually augmented as rapidly as trained men can be turned out from the Jorhat farm.

Maulvi Fazlal Haq Ahmed, Superintendent of Agriculture, was in charge of the work in this circle until September 1918, when he was transferred to the Surma Valley and Srijut L. Barthakur took over charge. At the same time the headquarters of the Superintendent of Agriculture, Assam Valley, was transferred from Jorhat to Gauhati.

Mr. Barthakur was on tour for 103 days, and visited all the districts and subdivisions within his charge. Soon after taking over charge he had to take 19 days' privilege leave owing to an attack of influenza.

Babu Satyendra Chandra Dutt held the post of Agricultural Inspector, Kamrup, throughout the year. He was also in charge of the Seed Depôt, Gauhati, up to November 23rd, 1918, when he was relieved by the Superintendent of Agriculture. He spent 161 days on tour, and for about a month was on special duty in connection with the distribution of sugarcane setts from the Kamrup farm. To assist him in demonstration work he had 3 demonstrators headquartered at Gauhati, Palasbari and Nalbari.

Srijut Golok Chandra Bora was in charge of demonstration work in Nowgong district. He was on tour for 200 days inclusive of journeys within 5 miles radius of headquarters. He was assisted by two demonstrators, one at Nowgong and the other at Kampur. The work in this district is hampered by lack of communications; also it was necessary to change both demonstrators during the year.

Goalpara district was brought into the scheme of demonstration work this year for the first time by the transfer of Srijut Lalit Mohan Das from Karimganj and his appointment as Agricultural Inspector, Goalpara, with headquarters at Dhubri, with effect from 15th January 1919. Since joining his new post he was on tour for 47 days. He has two demonstrators, one posted at Dhubri and the other at Goalpara. Recently he has been placed in charge of the work in the Garo Hills in addition to that of his own district.

Srijut Devi Prasad Gohain continued in the post of Agricultural Inspector, Sibsagar. He was on tour for 172 days, and also spent 20 days in charge of the distribution of sugarcane setts from the Jorhat farm. He was assisted by 3 demonstrators posted at Jorhat, Sibsagar and Golaghat.

Srijut Mohi Chandra Gogoi was appointed Agricultural Inspector on probation with effect from 28th July 1918. He was under training with the Agricultural Inspector, Kamrup, for about 4 months, and with the Agricultural Inspector, Sibsagar, for about a month. Subsequently he was appointed Agricultural Inspector, Lakhimpur, and joined his new post at Dibrugarh on January 13th, 1919. Including his period of training he was on tour for 147 days. Two demonstrators were sanctioned for the district, but up to the end of the year only one post had been filled.

The post of Agricultural Inspector, Sadiya Frontier, was held by Mr. M. Smith, who continued to work under the orders of the Political Officer at Sadiya. The work is supervised as far as possible by the Deputy Director of Agriculture.

A certain amount of work is being done in the Garo Hills by a Garo demonstrator, who until recently was under the control of the Agricultural Inspector, Khasi and Jaintia Hills. Towards the close of the year, the demonstrator was placed under the supervision of the Agricultural Inspector of the adjacent district Goalpara for the sake of convenience, since the main line of communications with the Garo Hills passes through that district.

3. Demonstration work in the Assam Valley.—This was continued on similar lines to that of previous years in Kamrup,

Sibsagar and Nowgong districts, and, on the appointment of the additional Inspectors, was extended to Goalpara and Lakhimpur districts.

The work was distributed under the following heads :—

- (1) *Rice*.—Manuring and variety demonstrations.
- (2) *Sugarcane*.—Demonstration with superior varieties green manuring for cane, and the use of the three-roller iron crushing mill.
- (3) *Potatoes*.—Demonstrations with superior varieties from Shillong, and large *versus* small tubers for planting.
- (4) *Jute*.—Finlow's "Kakiya Bombai" *versus* local varieties.
- (5) *Fodder crops and miscellaneous crops*.
- (6) *Meston ploughs*.
- (7) *Conservation of cattle manure*.—In covered pits.

4. *Rice*.—*Residual effect of manures in the third year*.—Bonemeal and Flour phosphate were applied in 1916 at the rate of 3 maunds per acre costing Rs. 9 and Rs. 10-8 per acre, respectively. The cost of green manuring with *dhaincha* was not more than Rs 2 per acre. The residual effect of this treatment in the third year is shown in the following table :—

Field in lb. of grain per acre.

District and centre.	Check or no manure plot.	Bonemeal plot.	Flour phosphate plot.	<i>Dhaincha</i> plot.	<i>Dhaincha</i> and Bonemeal plot.
1	2	3	4	5	6
SIBSAGAR.					
Bhojo	1,276	1,969	...	...	...
Langhak	1,138	1,320	...	...	...
Bethari	1,393	2,281	...	...	...
Rahdhola	1,006	983	...	...	...
Meleng	1,110	...	1,251	...	...
Patiagon	1,516	...	1,348	...	...
Morabazar	1,104	...	1,358	...	...
Parbatia	1,020	...	1,443	...	...

Yield in lb. of grain per acre—concl'd.

District and centre.	Check or no manure plot.	Bonemeal plot.	Flour phosphate plot.	Dhaincha plot.	Dhaincha and Bonemeal plot.
1	2	3	4	5	6
SIBSAGAR—concl'd.					
Average increase in the third year.	...	423	137	...	...
Previous increase in the second year.	...	102	150	...	...
Previous increase in the first year.	...	184	255	...	...
Total increase	709	542	...	...
KAMRUP.					
Tongra ...	854	...	...	854	1,477
Kuara ...	1,114	...	...	1,401	1,589
Average increase in the third year.	143	548
Previous increase in the second year.	— 38	204
Previous increase in the first year.	180	592
Total increase	285	1,344

Valuing the paddy at Rs. 3 per maund, and taking the total increase for the three years, the profit on the manuring works out as follows :—

—	Cost per acre.	Value of increase per acre.	Profit per acre.
1	2	3	4
Bonemeal ...	Rs. a. p. 9 0 0	Rs. a. p. 26 0 0	Rs. a. p. 17 0 0
Flour phosphate ...	10 8 0	20 0 0	9 8 0
G. M. dhaincha ...	2 0 0	10 0 0	8 0 0
Ditto plus Bonemeal...	11 0 0	49 0 0	38 0 0

5. *Rice—Residual effect of manures in the second year.*—These demonstrations were commenced in 1917 in Kamrup and Sibsagar, when Bonemeal, Flour phosphate and Rape cake were applied at the rate of 3 maunds, 3 maunds and 6 maunds per acre, respectively. The cost per acre of the manures was Rs. 9 for Bonemeal, Rs. 10-8 for Flour phosphate and Rs. 10-8 for Rape cake. The cost of green manuring with *dhaincha* is about Rs. 2 per acre.

In Kamrup at Parakuchi one plot which had been given a dressing of 3 maunds per acre of Bonemeal in 1914 was given a similar dressing in 1917 with the result that it yielded an increase of 619 lbs. paddy per acre in 1917, and 563 lbs. in 1918 over the unmanured check plot.

The manurial demonstrations commenced in Nowgong in 1917 having proved unreliable no results are given. The results of the demonstrations in Kamrup and Sibsagar are shown in the following table :—

SECOND YEAR'S RESULTS.

Yield of grain per acre in pounds.

District and centre.		Check or no manure plot.	Bonemeal plot.	Flour phosphate plot.	Flour phosphate and <i>dhaincha</i> green manure plot.	Bonemeal and <i>dhaincha</i> green manure plot.	<i>Dhaincha</i> green manure plot.	Rape cake plot.	Remarks.
1		2	3	4	5	6	7	8	9
SIBSAGAR.									
Kakojan ... ..	...	2,020	2,217	1,765	2,114	2,237	1,923	...	
Koarpur ... ..	...	2,169	2,089	2,204	1,956	1,854	1,554	...	
Sokanukhuri ... ..	...	1,688	1,636	1,461	1,430	1,478	1,374	...	
Setiani ... ..	...	1,335	2,044	2,209	2,305	2,305	1,607	...	
Average increase in the second year	...	...	343	261	311	340	— 41	...	
Previous increase in the first year ...	...	...	852	1,002	722	870	316	...	
Total increase in two years ...	...	...	1,195	1,263	1,033	1,210	275	...	

SECOND YEAR'S RESULTS—*concl'd.**Yield of grain per acre in pounds—concl'd.*

District and centre.		Check or no manure plot.	Bonemeal plot.	Flour phosphate plot.	Flour phosphate and dhaincha green manure plot.	Bonemeal and dhaincha green manure plot.	Dhaincha green manure plot.	Oilcake plot.	Remarks.
1		2	3	4	5	6	7	8	9
SIBSAGAR.									
Jalukain ... ..	...	1,660	2,329	...	...	...	...	...
Halkikhat ... ..	...	1,706	1,367	...	...	...	...	...
Bailungson ... ..	...	1,942	1,677	...	...	...	...	...
Napamun ... ..	...	1,452	...	1,622	...	...	...	...
Amalapati ... ..	...	1,413	...	1,563	...	...	...	...
Average increase in the second year	...	...	299	262	...	...	...	...
Previous increase in the first year ...	...	...	242	220	...	...	...	...
Total increase in two years ...	...	...	531	482	...	...	...	...
KAMRUP.									
Sandheli ... ..	...	1,407	...	...	...	1,536	1,410	...	Ass.
Dihramantola ... ..	...	2,246	...	...	...	2,120	3,009	...	Two crops soli and ass.
Nayagaon ... ..	...	1,246	...	...	...	1,334	1,119	...	Ass.
Rangernati ... ..	...	1,683	...	...	...	2,065	2,109	...	Soli.
Borpara ... ..	...	809	...	...	...	2,349	968	...	Soli.
Sandheli ... ..	...	1,353	...	...	...	...	...	1,780	Ass.
Bohali ... ..	...	1,495	...	...	...	...	...	1,740	Ass. and soli.
Sadilapur ... ..	...	1,327	...	...	...	...	...	1,617	Mito.
Average increase in the second year	...	...	...	...	...	404	240	360	
Previous increase in the first year ...	...	...	...	...	...	414	188	483	
Total increase in two years ...	...	...	...	...	...	818	429	793	

In the first series carried out in Sibsagar district the value of Bonemeal, Flour phosphate and green manuring with *dhaincha* was compared, and also green manuring in conjunction with the phosphatic manures. The results obtained in the two years are difficult to explain. While Bonemeal and Flour phosphate used alone show a profit of Rs. 33 and Rs. 36-12-0 per acre, respectively, and green manure a profit of Rs. 8-8-0 per acre, yet when green manure is given in addition to the phosphatic manures the result has been a reduction of profit to Rs. 34-6-0 in the case of Bonemeal, and to Rs. 26-4-0 in the case of the Flour phosphate, although Bonemeal *plus* green manure gave a slightly higher than Bonemeal used alone.

In the second series, also carried out in Sibsagar district, Bonemeal applied in three centres gave an average profit of Rs. 11 per acre over the two years, as against an average profit of Rs. 7-8-0 from Flour phosphate in two centres.

In the third series laid down in Kamrup district *dhaincha* for green manure was tried with and without Bonemeal in five centres. In three cases the addition of Bonemeal resulted in increased outturn, but in the two remaining centres green manure alone gave the better results. Taking the average increases for the two years together, however, the green manure, *plus* Bonemeal shows a profit of Rs. 13-12-0 per acre against Rs. 11 for the green manure alone.

At three centres in Kamrup plots manured with rape cake were compared with no manure plots. The results were very even, and show an average increase per acre over the no manure plots of 762 lb. paddy for the two years or a nett profit of Rs. 18 per acre.

All the above demonstrations are being kept under observation with the object of recording results for the third year.

6. *New manurial demonstrations on rice.*—In 1918 demonstrations with Bonemeal and Flour phosphate were commenced in three new centres in Sibsagar, and with green manure, bonemeal and oilcake in seven centres in Kamrup district. The first year's results are shown in the following table. Except in the case of oilcake the increases in the first year due to manuring are nothing like sufficient to pay for the manures. The effect of the phosphatic manures however should be apparent for at least three years, and the plots will be kept under observation and the results recorded for this period.

NEW RICE MANURIAL DEMONSTRATIONS.

Grain in pound per acre.

District and centre.	Check or no manure plot.	Flour phosphate plot.	Bonemeal plot.	Dhaincha plot.	Dhaincha and Bone meal plot.	Oilcake plot.	Remarks.
1	2	3	4	5	6	7	8
SIBSAGAR.							
Bachapathar	986	...	849	...	...	...	...
Jogiagaon	292	...	568	...	...	...	...
Rupkalia	1,034	1,177	...	...	...	...	...
Average increase ... ..	...	143	69	...	...	...	...
KAMRUP.							
Nalbari	1,517	...	...	1,825	1,766	...	Salt.
Agdala	1,240	...	...	1,300	1,270	...	"
Dumnichaki	1,251	...	...	1,575	1,612	...	"
Dokhola	1,225	...	...	1,122	1,579	...	"
Uparhali	1,708	...	...	...	...	2,346	Aus & Salt.
Surañih	2,157	...	...	...	...	2,572	Aus.
Satpar	928	...	...	...	...	1,034	Salt.
Average increase ... ..	...	...	...	147	248	386	...

7. Remarks on paddy manurial demonstrations generally.—
 These demonstrations have been continued in the Assam Valley for the last six years on a gradually increasing scale as the demonstration staff has been increased, but in spite of the fact that

in the majority of cases it has been proved beyond doubt that manuring, and especially phosphatic manuring, pays handsomely in the long run, yet it is a melancholy fact that up to the present time practically no impression has been made on the ordinary cultivator, as witnessed by the demand for these manures which is practically *nil*. The reason for this is partly want of enterprise and partly lack of capital amongst the cultivators, and until pressure of population compels them to adopt a more intensive system of cultivation I doubt whether it will be possible to make much progress.

However the demonstrations have not been entirely wasted since they have shown that, on certain classes of land in the Assam Valley, phosphate is one of the main factors in increasing the yield of rice, but in future more care will have to be taken in the selection of sites, and the demonstrations should be strictly confined to old land which has been cultivated more or less continuously for generations, and on which the crops have fallen considerably below the average.

8. *Demonstrations of superior varieties of rice.*—*Indra sail*, a pure variety selected by Mr. Hector at Dacca, and *George sail* selected by Srijut Narayan Borua of Nakacheri were demonstrated in Sibsagar, Kamrup and Nowgong districts. *George sail* is not quite pure, but is a considerable improvement on the local varieties. The results are given in the following table. It will be seen that both the improved varieties, and especially *Indra sail*, have given promising results. There is much more scope for this kind of work than for the introduction of manuring, as the cultivation of a superior yielding variety means no extra initial outlay for the cultivator once he has obtained the seed. At the same time it must be borne in mind that heavier cropping varieties take more out of the soil, with the result that unless manuring is resorted to eventually the yield will gradually diminish until the old level is reached. Thus improvements in Agriculture to be permanent must proceed on parallel lines of better varieties, better cultivation and suitable manuring.

In order to introduce these varieties more widely to cultivators arrangements have been made this year to distribute 40 maunds of *Indra sail* and a few maunds of *George sail* in 5 seer bags, on the understanding that cultivators to whom the seed is given will return an equal quantity to be distributed amongst their neighbours in the following year.

Yield of grain per acre in pounds.

District.	Local paddy.	Indra sali.	George sali.	Increase
1	2	3	4	5
SIBSAGAR.				
Average of 9 demonstrations ...	1,391	1,669	...	278
Ditto 6 demonstrations ...	2,169	...	2,403	234
KAMRUP.				
Average of 7 demonstrations ...	1,535	1,893	...	358
Ditto 8 demonstrations ...	1,630	...	1,626	86
NOWGONG.				
Average of 6 demonstrations ...	1,637	1,843	...	206

In addition to the demonstration with the *Indra sali* and *George sali* the following varieties with special characteristics of their own were distributed in small quantities in Kamrup and Sibsagar districts—*boro* paddy, *Gandhi sali* (a late variety from Eastern Bengal), *parang* paddy (late variety of *aus*), *C. P. fin aus*, *Basanta Bahar* (a fine white variety of *aus*), and *Khorik Motha* (a medium white variety of *aus*).

9. *Sugarcane—variety demonstrations.*—Demonstrations of improved varieties introduced and tested on the Jorhat farm have been carried out for some years, and are gradually being extended to all parts of the Valley where sugarcane is grown.

The introduced varieties, *viz.*, striped Mauritius, B. 37/ and B. 147 have proved superior to the local varieties both in outturn and quality of *gur*, and that this is appreciated by the cultivators is evident by the large and increasing demand for setts of the superior varieties. The number of setts distributed this season was over 3½ lakhs, of which about one-third were sold at the rate of annas eight per hundred, and the remainder used for demonstration purposes, and distributed to growers on the

understanding that they will reproduce them for further distribution next year. The following table gives details of the demonstrations carried out during the year :—

Outturn of gur per acre in pound.

Locality.	Improved variety.	Local variety.	Remarks.
1	2	3	4
SIBSAGAR.			
amunggaon	2,051 B.376 ..	2,022 Magh ...	Plant cane.
inguri	8,228 " ...	2,569 Kolapura	"
fourghat	2,568 " ...	1,432 " ...	"
apithar	7,834 " ...	7,653 " ...	"
apamua	3,720 " ...	2,541 Teli ...	"
NOWGONG.			
Ukampur	4,557 Striped Mauritius.	2,630 Magh ...	"
KAMRUP.			
banoria	3,993 " ...	2,843 ...	"
banajpara	2,440 " ...	1,532 ...	"
SIBSAGAR.			
runthora	1,660 Striped Mauritius.	529 Kolapura ...	Ratoon cane.
amunggaon	7,265 Striped Mauritius and B.376.	4,567 " ...	"
baringia	8,77 B.376 ...	695 Teli ...	"
brucw	5,078 Striped Mauritius.	3,693 Kolapura	"
KAMRUP.			
harmatala	3,344 B.147 ..	1,672 ...	"

The results are, as usual, very satisfactory. In the demonstration with plant cane the average yield of gur of the improved varieties is 4,419 lbs. per acre against 3,028 lbs. for the local varieties—an increase of 1,391 lbs. per acre or over 45 per cent. The demonstrations with Ratoon cane show an average yield of 2,705 lbs. per acre for the improved varieties against 213 lbs. for the local varieties an increase of 1,492 lbs. per acre or over 67 per cent.

10. *Sugarcane—green manuring.*—As a preparation for cane, cowpeas were demonstrated in three centres in Sibsagar, and *dhaincha* in two centres in Kamrup. Both these crops have proved successful for green manuring on the Government Experiment Stations for many years.

The results are shown in the following table :—

District and centre.				Kind of green manuring.	Variety of cane.	Green manured plot.	Check plot.	Difference.
1				2	3	4	5	6
SIBSAGAR.								
Nowalia	...	...	...	Cowpea	Magh	1,875	1,694	181
Borkathani	...	...	...	"	"	5,021	3,660	1,361
Sensoa	...	...	...	"	"	3,569	2,135	1,434
Average	...	...	...	...	...	...	...	992
KAMRUP.								
Dohali	...	...	...	<i>Dhaincha</i>	Striped Mauritius.	3,720	1,104	2,616
Nayagaon	...	...	...	"	"	2,510	1,300	1,210
Average	...	...	...	...	...	...	...	1,913

The average increase in yield of *gur* in Sibsagar due to green manuring with cowpea was 992 lbs. per acre, value about Rs. 60, while that in Kamrup due to green manuring with *dhaincha* was 1,913 lbs. per acre, value about Rs. 116. It would appear from these results that green manuring for sugarcane in the Assam Valley is one of the most profitable improvements that can be introduced. Land going under sugarcane is usually left fallow the preceding year and often for several years, so green manuring will not mean the loss of other crops. The cost also is small compared with that of direct manuring; in the case of *dhaincha* only some Rs. 2 per acre for seed and in that of cowpeas about Rs. 4-8, in addition to labour for cultivation. The chief obstacle to the spread of this practice is the unenclosed land system common to this country. The cultivator fences his sugarcane crop, but it takes a good deal of persuasion to get him to fence his field a year ahead for the protection of the green

manure crop. However, unless this done, the benefit derived from the cultivation of green manure crops is largely wasted, since the roving herds of cattle and goats let loose in the vicinity of every village will quickly destroy the crop soon after germination.

The remarks in paragraph 8 with regard to improvement in rice cultivation apply equally in the case of sugarcane. No real and permanent improvement can be expected until the cultivators realise that, alongside the introduction of better varieties, their methods of cultivation must be improved, and systematic manuring of the crops must be taken in hand.

11. *Sugarcane mills*.—Demonstrations with three-roller iron sugarcane mills and shallow iron boiling pans were continued as in previous years. As a result of these demonstrations the old wooden mills at one time in common use in the Valley are gradually being replaced by iron mills. The chief obstacle to a more rapid advance is the price of the iron mills which has now increased to Rs. 80 as compared with Rs. 65 the pre-war price. Nevertheless 33 mills were sold during the year, 22 in Kamrup, 12 in Nowgong, 3 in Sibsagar and 1 in Golapara. A few boiling pans also were sold, and some spare parts for mills. Since the introduction of the iron mills was taken up the Department has sold over a hundred mills in the Assam Valley. With their increasing distribution the question of repairs to the mills is becoming difficult, and the need for some agency other than the Agricultural Department to take up the sale of, and to arrange for repairs to the mills, is urgent. It was hoped that, with the increasing demand created by the Department, private enterprise would step in and relieve us of the commercial side of the work, but up to the present there are no signs of this happening. We have now got to the stage when, in the absence of private enterprise, it should be considered whether the Department would be justified in extending the work by employing a staff of mistris to keep the mills in repair.

12. *Potatoes—demonstrations with superior varieties from Shillong*.—A number of demonstrations of the superior varieties Magnum Bonum and King of Potatoes from Shillong were carried out in Sibsagar, Kamrup and Nowgong districts. In each case the Shillong "seed" was planted alongside "desi seed" ordinarily used by the cultivator and procured from the local bazar. The results given in the following table prove the superiority of the Shillong varieties in every case. The demand for Shillong seed potatoes in the Valley is increasing as a result of these and of previous demonstrations, and over 600 maunds were sold in 1918 against 213 maunds in 1917.

DEMONSTRATIONS WITH SUPERIOR VARIETIES OF POTATOES.

Yield per acre in pounds.

Locality.	Shillong variety.	Deahi variety--bazar seed.	Remarks.
1	2	3	4
SIDSAGAR.			
Alimur (Majuli) ...	11,787	8,064	
Mirigaon (Majuli) ...	9,133	6,261	
Betbari ...	3,515	1,251	
Sokolaghat ...	2,700	2,400	
Kaliani ...	8,140	2,551	
Average ...	5,880	3,454	Average increase 2,426.
KAMRUP.			
Solunari ...	9,755	5,521	
Majirgaon ...	4,806	3,454	
Lakhitari ...	4,192	3,856	
Agolalu ...	8,061	4,401	
Dowlu ...	4,961	3,720	
Average ...	6,415	4,190	Average increase 2,225.
NOWGONG.			
Telahi ...	6,367	1,724	
Gomothagaon ...	2,953	2,489	
Rangagera ...	5,748	4,790	
Dhing ...	7,648	3,805	
Average ...	5,613	3,269	Average increase 2,394.

13. *Potatoes—demonstrations with larger seed.*—The usual practice of cultivators in the plains is to plant very small tubers for the sake of economy in "seed". In order to prove to them the advantage of planting larger tubers, demonstrations with medium sized *versus* small setts were carried out in Sibsagar, Kamrup and Nowgong districts. The small setts weighed about 70 to 80 to the seer and the medium setts about 30 to 40 to the seer. Thus planting the same number of each size per unit area, the weight of medium sized tubers required was just about twice that of the small tubers.

The results were greatly in favour of the larger seed which gave an average increase outturn of 4,333 lbs. per acre in Kamrup, 2,346 lbs. per acre in Sibsagar and 2,032 lbs. in Nowgong.

The extra cost of the larger setts at Rs. 5 per maund would probably amount to about Rs. 25 per acre, while taking the sale price of the crop at the low rate of Rs. 2 per maund, the average increase due to planting the larger setts amounts to about Rs. 70 per acre in value.

14. *Jute—demonstrations of Mr. Finlow's selected variety "Kakiya Bombai."*—These were carried out in several centres in Kamrup, Nowgong and Sibsagar districts. The results of the Sibsagar demonstrations are not considered reliable and have been omitted. The results of the demonstrations in the other two districts are given below.

The demand for "Kakiya Bombai" is increasing rapidly especially in the lower districts of the Valley. This year we purchased 10 maunds seed of this variety from Messrs. Birkmyre Bros., Kamrup, 8 maunds from Maulvi Taiyab Ali, Honorary Correspondent of the Department, and a small quantity from Badu Jyotish Chandra Chakravarty. The bulk of this has been distributed in half pound packets to cultivators.

In order to provide a supply of seed for next year, five acres has been sown on the Kamrup Surgarcane firm and arrangements have been made with Maulvi Taiyab Ali to grow more seed for us. In addition to this three bighas have been sown for seed in Nowgong district.

Outturn of fibre per acre in pounds.

District and centre.	Kakiya Bom- "bui" jute.	Local jute.	Remarks.
1	2	3	4
NOWGONG.			
Sonaibali	1,240	1,059	Average increase 252 lbs. per acre.
Rupahi	1,253	1,002	
Jamunamukh	1,176	849	
KAMRUP.			
Amingaon	1,391	1,240	Average increase 155 lbs. per acre.
Sadilapur	707	647	

- 15. *Fodder and miscellaneous crops.*—Cowpeas alone and cowpeas and maize mixed were grown successfully for fodder at three centres in Kamrup district, but it is reported that cultivators generally take no interest whatever in our attempts to introduce fodder crops. This is not surprising in localities where grazing land is still abundant, but in view of the fact that lack of sufficient grazing grounds is put forward from time to time by various people as an explanation for the existence of an inferior breed of cattle, it is curious that fodder crops are so universally unpopular with the cultivators. The fact is that the extensive communal grazing practised in Assam is itself largely responsible for the condition of the local cattle as, so long as this is continued, breeding will go on in the present haphazard fashion, and feeding will continue to consist of what the cattle can pick up for themselves.

Miscellaneous cold weather crops were introduced at a few centres in Kamrup, Sibsagar and Nowgong. The exceptionally dry season was unfavourable, and consequently the results were not very promising. Wheat was grown in 3 centres in Sibsagar district, the average outturn being 907 lbs. of grain per acre. In Nowgong the average yield of this crop at two centres was only 433 lbs. per acre. Other crops tried included *Masur*, *Khesari*, barley, gram, Raipur mustard, etc., but owing to the indifference of the cultivators with regard to cold weather crops generally the demonstrations on the whole were not a success.

Garo, Buri and Jati cotton seed was distributed in small quantities to a few cultivators in Kamrup district. In one case Jati cotton is reported to have given an outturn of 14 seers kapas on about 1,000 square feet of land. This is about 15 maunds per acre.

16. *Meston ploughs*.—Demonstrations with these implements were continued during the year and 7 ploughs were sold to cultivators in Kamrup. Although the utility of these ploughs is beginning to be appreciated by the cultivators, the present high price prevents them from becoming popular.

17. *Conservation of cattle manure*.—Demonstrations of the method of conserving cattle manure in covered pits, and in sheds above ground where the water level in the rains is too high for pits, were continued throughout the Valley. During the year 15 of these demonstrations were carried out in Sibsagar district, 1 in Kamrup, 4 in Nowgong and 3 in Lakhimpur.

18. *Agricultural work on the Sadiya Frontier*.—Mr. M. Smith held the post of Agricultural Instructor throughout the period under report.

There are small experimental stations at Sadiya, Pasighat and Rotung. At Sadiya the area of land taken up is about 10 acres, of which $7\frac{1}{2}$ acres is under cultivation, the main object being to demonstrate the cultivation of fruit, vegetables and other crops with a view to their introduction in the locality. The following crops were grown during the year :—

Hot weather vegetables.—Melons, gourds, ladies' fingers, etc., about an acre of land did well and the produce was distributed to the patients at the local hospital.

Cold weather vegetables.—Cabbages, Cauliflowers, knol kholis, peas, etc., were grown on an area of about 2 acres. The outturn was very satisfactory, and the sale proceeds amounted to Rs. 825 which was credited in the local treasury. Vegetable seedlings were also distributed to villagers in the locality.

Potatoes.—Two maunds of local seed and $4\frac{1}{2}$ maunds of Shillong "seed" were planted. The outturn of the Shillong "seed" was $39\frac{1}{2}$ maunds, and that of local "seed" just over 6 maunds, the Shillong potatoes proving about three times as prolific as the local variety.

Groundnuts—planted on about $\frac{1}{2}$ acre in the old nursery yielded at the rate of 21 maunds per acre, which is a very satisfactory result. Five seers of seed was distributed in Poshin village by the "Gam" with good results.

Aus paddy—was sown on about 2 acres and gave a total outturn of no less than 63 maunds of grain equal to $31\frac{1}{2}$ maunds per acre. This is about double the average yield for the province.

Wheat—Five seers was sown on $\frac{1}{4}$ acre, and yielded $2\frac{1}{2}$ maunds, or at the rate of 10 maunds per acre. The outturn would have been greater had not part of the crop been destroyed by rats and birds.

Oats—did very well yielding 2 maunds 36 seers from $\frac{1}{2}$ th acre, or at the rate of over 20 maunds per acre.

Sugarcane.—Striped Mauritius, B. 376 and B 147 from the Jorhat farm occupied an area of about $\frac{3}{4}$ acre, and made good growth. Crushing and *gur* boiling were in progress at the end of the year, and the results will be recorded in next year's report.

Coffee—is being tried experimentally. The plants, which are still in the nursery, are making good progress.

Fruit.—Lichi, guava, peach, orange, lime and pomelo trees have been planted and are doing well. At present all the trees are very young and have not yet come into bearing.

At Pasighat a small garden about an acre in extent was opened during the year for the growth of vegetables. In this vicinity on $3\frac{1}{2}$ acres of terrace cultivation a crop of over 100 maunds of paddy was obtained.

At Rotung $12\frac{1}{2}$ acres of land have been terraced for wet rice. This work is supervised by two Angami Nagas who act as instructors in the art of terracing. The outturn of paddy from this area was 480 maunds, or at the rate of over 38 maunds per acre—an exceptionally heavy yield.

For the improvement of the local cattle a bull from the Shillong farm is kept at Pasighat, and cattle owners are charged at the rate of Rs. 2-8 for his services. In this locality the Instructor castrated 62 weedy bulls during the cold weather. A few were castrated at Sadiya, but operations had to be stopped on the outbreak of foot-and-mouth disease.

19. *Agricultural work in the Garo Hills*.—The work in this district is in charge of one demonstrator, a Garo named H. M. Momin, who was formerly under the supervision of the Agricultural Inspector, Khasi and Jaintia Hills, but recently has been put under the Agricultural Inspector, Goalpara. He was on tour for 191 days.

The greater part of the district is hilly and cultivation is on the *jhum* system of mixed cropping. The principal crops are paddy and cotton.

"*Jhum*".—*paddy*—Demonstrations were carried out in 3 centres with Garo varieties and in 3 centres with Khasi varieties. The Khasi varieties failed. The Garo varieties gave an average outturn of $20\frac{1}{2}$ maunds per acre.

Wet paddy—Demonstrations were also carried out with Garo varieties in 3 centres and with Khasi varieties in 3 centres.

The Khasi varieties failed, and the Garo variety in one centre was destroyed by deer and wild pigs. The remaining two centres gave an average outturn of 31 maunds per acre of Garo paddy.

Potatoes.—Were demonstrated at 9 centres. Area of plots in 8 centres was $\frac{1}{10}$ acre and in 1 centre was $\frac{1}{2}$ acre. Thus the total area in all centres was 1 acre. The variety was King of Potatoes from Shillong, and the seed rate 10 maunds per acre. The outturn varied from $18\frac{1}{2}$ to $56\frac{1}{2}$ maunds per acre, the average of the 9 centres being $42\frac{1}{4}$ maunds per acre. The results are not good owing to late arrival of the seed.

Cotton.—Demonstrations in 3 centres with yellow cotton were unsuccessful owing to impure seed.

Groundnuts—were tried in two centres. In one centre where cowdung manure was applied the yield from $\frac{1}{10}$ acre was 10 seers, or at the rate of 5 maunds per acre. In the other centre where no manure was given the yield was 8 seers or at the rate of 4 maunds per acre. These yields are very poor, but the crop is reported to have been attacked by white ants.

Grafting and pruning of fruit trees.—Four mangoes were grafted, 86 oranges were pruned and 6 root pruned by the demonstrator.

20. *Distribution of seeds, implements, manures, etc., including the work of the Seed Depot, Gauhati*.—This work was extended considerably during the period under report. With the exception of the distribution of sugarcane setts, which was undertaken by the District Agricultural Inspectors, the arrangements for the supply of seeds, manures and implements, etc., is undertaken by the Seed Depot, Gauhati.

Sugarcane setts of the varieties Striped Mauritius, B. 376 and B. 147 were distributed from several centres in the Valley, the total number of setts dealt with being over $3\frac{1}{2}$ lakhs. The

sources of supply and the number distributed in each locality are noted below :—

Source of supply.				Distribution.			
Kamrup farm	...	...	2,55,000	Kamrup	...	...	1,20,000
Jorhat	..	...	61,000	Sibsagar	...	...	1,10,000
Sibsagar jail	...	...	12,000	Nowgong	...	...	50,000
„ cane-growing centres			5,000	Goalpara	...	...	23,000
Kamrup	..	...	32,000	Lakhimpur	...	...	12,000
				Surma Valley	...	...	42,000
Total				Total			
	...		3,68,000		...		3,68,000

In Kamrup the majority were sold at the rate of annas eight per hundred. In Goalpara 18,000 were sold. The remainder were distributed free for demonstration purposes and with a view to forming centres for next year's supply of setts.

The work of the Seed Depot has expanded rapidly since the introduction of the system whereby sale proceeds are credited against expenditure.

During the 9 months covering the period under report the total quantity of seeds and manures issued was 970 maunds, value Rs. 4,855, while the number of implements, etc., was 78, value Rs. 3,792. Of these quantities, 724 maunds of seed, etc., value Rs. 3,599, and 62 implements, etc., value Rs. 3,140, were actually sold to the public and the receipts credited in the local treasury, the remainder being distributed free for demonstration purposes and to Government farms.

The quantity of manures supplied was practically negligible. Of seeds the chief amounts were 823 maunds of seed potatoes, value Rs. 3,867, of which 673½ maunds, value Rs. 3,095, were sold and the remainder used for demonstration purposes, 10½ maunds jute, value Rs. 148, of which 4 maunds were sold and the remainder distributed free, and 25 maunds of oats, value Rs. 129, of which 17 maunds were sold. Of implements the main issues were iron sugarcane mills, of which 38, value Rs. 2,950, were actually sold and 6, value Rs. 480, were sent out for demonstration work.

Altogether 36 kinds of seeds, 3 kinds of manure, 4 kinds of implements (excluding spare parts) were dealt with during the year.

A promising new line of work was the sale of two-anna packets of Sutton's English vegetable seeds. These appear to have immediately secured popularity with the public, as the sale amounted to Rs. 135.

The accompanying statement shows the working of the Depot for the year under report. The nett cost of the working of the Depot allowing depreciation and increase of stock was Rs. 467.

A statement showing the working of the Gauhati Seed Depot for the nine months ending 31st March 1919.

Assets or receipts.		Liabilities or charges.	
1		2	
	Rs. a. p.		Rs. a. p.
Total amount realised from sale in year under report (i.e.), from 1st July 1918 to 31st March 1919.	6,733 0 6	Rent	321 12 0
		Establishment	313 8 0
Debt outstanding of last year realised in year under report.	243 10 3	Contingencies	685 7 0
		Depreciation in value of stock in hand at 10 per cent. of cost price.	36 4 0
Receipts of current year ...	6,439 6 3	Cost of purchasing stores ...	7,931 11 3
Add—		Cost of stores supplied free from farms, etc.	299 6 9
Bills outstanding	508 13 0	Cost of bills outstanding on account of stores purchased.	134 2 9
Value of stores supplied free to the Honorary Correspondents and farms and for demonstration purposes.	1,961 3 2		2,632 3 9
	8,959 6 5	Cost price of stock in hand on 1st July 1918.	172 6 9
Profit and loss account ...	466 12 1	Cost price of stock in hand on 31st March 1919.	363 7 9
Total ...	9,26 2 6	Increase in stock	191 1 3
		Total	9,426 2 6

21. *Work of Honorary Correspondents.*—There are 14 Honorary Correspondents in the Assam Valley and one in the Garo Hills.

Maulvi Taiyab Ali of Sonapur rendered much assistance to the Department by growing *Indra sail* paddy and Kakiya Bombai jute for seed. He supplied 8 maunds of jute seed to the Seed Depôt.

Srijut Pitambar Saikia of Kowang, Lakhimpur, is reported to have grown Garo cotton successfully on a large scale, and Maulvi Zubaid Ali Hazarika of North Lakhimpur made an experiment with Shillong varieties of potatoes.

A. G. BIRT,

Deputy Director of Agriculture, Assam Valley.

REPORT ON AGRICULTURAL DEMONSTRATIONS IN
THE SURMA VALLEY CIRCLE FOR NINE MONTHS
ENDING THE 31st MARCH 1919.

The demonstration work was in charge of Srijut Laksheshwar Barthakur, Superintendent of Agriculture, until October 1918, when he was transferred to the Assam Valley, and replaced by Maulvi Fazlal Haq Ahmed. The former was on tour for 60 days and the latter for 152 days.

In addition to the district demonstration work, the Superintendent had charge of the recently established seed depôt, and of special work in connection with the destruction of Water Hyacinth in Habiganj.

Probably owing to these transfers, there were signs of some slackening of activity in the agricultural work. The seed depôt has now been established on a firm basis and the district work is going on satisfactorily. Separate notes on the demonstration work in Sylhet and in Cachar, on the Sylhet Seed Depôt, and on Water Hyacinth work are given.

AGRICULTURAL DEMONSTRATIONS IN SYLHET.

2. The district consists of the five subdivisions of North Sylhet, South Sylhet, Habiganj, Karimganj and Sunamganj. No work has yet been attempted in Sunamganj. At the beginning of the period Karimganj formed part of the charge of Srijut L. M. Das and Babu Binode Bihari Das was in charge of the other three subdivisions. Consequent upon the transfer of the former in January and the appointment, at the same time, of Babu Prafulla Chandra Dutta as Agricultural Inspector, South Sylhet and Habiganj, Binode Babu's charge was altered to that of North Sylhet and Karimganj subdivisions.

The demonstration centres were distributed over all these subdivisions, and the Agricultural Inspectors were helped in the district work by five demonstrators with headquarters at Sylhet, Kulaura, Maulvi Bazar, Shaistaganj and Barlekha. The Agricultural Inspector, Sylhet, was somewhat handicapped in his district work on account of changes in his demonstration staff. The services of the Kulaura demonstrator had to be dispensed with at a time when he ought to have been engaged in organising cold-weather demonstrations. His successor died after only

a few week's work and it was some weeks before another man was available to fill the vacancy. Another demonstrator was absent for two months owing to the attack of influenza.

District work had to be largely held in abeyance in the early part of 1919 owing to the Agricultural Inspectors of Sylhet and Habiganj being put in charge of Water Hyacinth ash operations at Murakari and Bejura, respectively.

Babu B. B. Das was on tour for 186 days and Babu P. C. Dutta for 72 days from the time of his appointment to a separate charge in the middle of January.

3. The agricultural operations were continued along the same lines as in previous year and now consist of the following :—

- (a) Paddy manurial tests.
- (b) Trial with superior varieties of paddy.
- (c) Introduction of superior sugarcane and 3-roller iron mills.
- (d) Introduction of Shillong potatoes.
- (e) Jute demonstrations.
- (f) Trial with new crops :—Groundnuts, fodder crops, cereals, pulses and oilseeds.
- (g) Miscellaneous :—Trials with Weston plough, conservation of cattle manure in covered pits or sheds.

Paddy manurial demonstrations laid down in 1918 consisted of the following :—(a) Bonemeal, (b) Bonemeal and dhaincha, (c) Limestone and dhaincha, (d) Bonemeal and oilcake, (e) Oilcake (f) Dhaincha green manure.

In North Sylhet the tests are discouraging, as they have not even gone so far as to return the bare cost of manuring. In South Sylhet the increased yields from bonemeal alone, bonemeal and oil cake, and Dhaincha green manuring were sufficient to leave a slight profit. In Karimganj the manures gave encouraging results, whereas in Habiganj the results were unsatisfactory. Bonemeal was applied at the rate of 247 pounds, ground limestone 823 pounds, oilcake 494 pounds and dhaincha seed

was sown at the rate of 30 pounds per acre. The yields from the various manures are shown in the accompanying abstract :—

Kind of treatment.	Number of tests.	Average in course in outlines.	Value of the increased crop at Rs. 2-8-0 per maund.	Cost of manuring.	Profit loss.	Remarks.
1	2	3	4	5	6	7
			Rs. a. p.	Rs. a. p.	Rs. a. p.	
Bone-meal	2	216	6 12 0	9 0 0	-2 4 0	North Sylhet.
Bone-meal and Dhaincha ...	2	182	5 11 0	10 12 0	-5 1 0	
Limestone and Dhaincha ...	2	135	4 8 0	11 12 0	-7 4 0	
Bone-meal and oilcake ...	3	564	11 6 0	16 8 0	-5 2 0	
Oilcake	1	-289	-9 0 0	6 0 0	-15 0 0	
Bone-meal	3	1,031	10 5 0	9 0 0	1 5 0	South Sylhet.
Bone-meal and Dhaincha ...	2	178	5 9 0	10 12 0	-5 3 0	
Limestone and Dhaincha ...	2	115	4 11 0	11 12 0	-7 1 0	
Bone-meal and oilcake ...	4	431	14 1 0	10 8 0	3 9 0	
Oilcake	2	185	5 12 0	0 12 0	-6 4 0	
Dhaincha green manuring ...	1	189	5 14 0	1 12 0	4 2 0	
Bone-meal	9	163	8 3 0	9 0 0	-0 13 0	Karimganj.
Bone-meal and Dhaincha ...	1	-113	-7 1 0	10 8 0	-17 9 0	
Limestone and Dhaincha ...	1	-386	-12 1 0	11 12 0	-23 13 0	
Limestone and Bone-meal ...	1	649	20 9 0	19 0 0	1 7 0	
Oilcake	3	355	11 1 0	12 0 0	-0 15 0	
Bone-meal	3	152	4 12 0	9 0 0	-4 4 0	Habiganj.
Bone-meal and Dhaincha ...	3	446	13 15 0	10 12 0	3 3 0	
Limestone and Dhaincha ...	1	-102	-3 3 0	11 12 0	-14 15 0	
Bone-meal and oilcake ...	2	73	2 7 0	10 8 0	-8 1 0	
Dhaincha	2	223	6 15 0	1 12 0	5 3 0	
Oilcake	2	303	9 8 0	12 0 0	-2 8 0	

The above demonstrations were distributed over the following centres :—Dharmada, Baraya, Renga, Jalalpur, in North Sylhet, Langla, Maulvi Bazar, Balisira, Srimangal, Goyasnagar in South

Sylhet, Barleka, Chotalekha, Patharia, Shahbazzpur, Fakimbazar, Gangajal in Karimganj, Shaistaganj, Narpati, Ramsiri, Satiyajuri, Surma, Taliapara in Habiganj.

4. The residual effect of bonemeal and dhaincha, bonemeal, bonemeal and oilcake and oilcake, etc., applied in 1917 were observed by weighing the crops produced in 1918 from the plots so treated.

The results over the two years will be found in the abstracts given below :—

Kind of treatment.	Number of demonstrations.	Average increase in 1918.	Average increase in previous year.	Total average increase.	Value of the total increase at Rs. 28-0 per maund.	Cost of manuring.	Profit and loss.	Remarks.
1	2	3	4	5	6	7	8	9
					Rs. s. p.	Rs. s. p.	Rs. s. p.	
Bonemeal ...	6	100	436	546	17 6 0	9 0 0	8 6 0	
Bonemeal and Dhaincha ...	4	343	226	668	17 12 0	10 12 0	7 0 0	
Bonemeal and oilcake ...	2	-14	281	267	8 5 0	10 8 0	-(2 3 0)	
Oilcake ...	1	445	276	721	23 8 0	12 0 0	10 8 0	
Dhaincha ...	1	-3	238	325	10 2 0	1 12 0	8 6 0	
Bonemeal ...	3	67	426	493	15 6 0	9 0 0	6 8 0	
Oilcake ...	1	140	-97	43	1 6 0	15 0 0	-(10 10 0)	
Bonemeal and Dhaincha ...	1	292	282	674	17 15 0	10 12 0	7 3 0	
Bonemeal ...	5	326	726	1,122	36 1 0	9 0 0	28 1 0	
Bonemeal and Dhaincha ...	5	193	991	1,185	37 0 0	10 12 0	26 4 0	
Bonemeal and oilcake ...	1	625	612	1,037	32 6 0	10 8 0	21 14 0	
Bonemeal and limestone ...	1	220	643	873	27 4 0	19 0 0	8 4 0	
Oilcake ...	2	-55	76	25	0 12 0	12 0 0	-(12 4 0)	
Bonemeal and oilcake ...	1	77	611	688	21 8 0	10 8 0	11 0 0	
Bonemeal ...	1	-164	464	300	9 6 0	9 0 0	0 6 0	
Oilcake ...	1	248	533	681	18 2 0	12 0 0	6 2 0	

The above demonstrations were distributed over the following centres.—Sultanpur, Baraya, Gutatkar, Khitta, Tukerbazar, Dakhingach, Jalalpur in North Sylhet, Chhotalekha, Shahabazpur, Rajnagar in Karimganj, Shaistaganj in Habiganj.

The results for three years of manures applied in 1916 are given below :—

Kind of treatment.	Number of demonstrations.	Average increase in 1916.	Average increase in previous year.	Total average increase, 3 years.	Value of increase crop.	Cost of manuring.	Profit.	Remarks.
1	2	3	4	5	6	7	8	9
					Rs. a. p.	Rs. a. p.	Rs. a. p.	
Bone-meal	7	180	796	963	30 11 0	9 0 0	21 11 0	
Foscol-meal	7	424	974	1,398	44 11 0	9 0 0	35 11 0	
Bone-meal and Dhaincha ...	2	369	604	932	29 2 0	10 12 0	18 6 0	
Dhaincha... ..	2	734	263	995	31 1 0	1 12 0	29 5 0	

The above demonstrations were distributed over the following centres :—Ganganagar, Tuckerbazar and Chhotalekha in Karimganj.

5. With a view to introduce the superior varieties of paddy George and Indra sail, a number of demonstrations was arranged in the district. Unfortunately the selection of sites was in some cases defective, the germination of the seed in others was poor, and in other cases considerable damage was caused to the seedling by flood. The results are not so reliable as could have been desired, nevertheless Indra sail has shown an increase of 263 pounds per acre over the best local varieties.

6. For sugarcane the record is disappointing. This is due to the bad germination of the sets and the general unsuitable character of the rainy season which admitted of no proper cultivation. Although 42 demonstrations were laid down and although few of them were really satisfactory, the canes are much appreciated by the cultivators and there is a considerable demand for further supplies from the districts where satisfactory crops

were grown. The three-roller iron mills was demonstrated successfully in the subdivisions of Karimganj, South Sylhet, Habiganj; as a result six mills were sold and more could have been disposed of had they been available in time. The results of crushing demonstrations given at various centres near Bhanugach, Manu, Chhotalekha, Ramchandrapur, and Shaistaganj showed that on the average 10 to 15 per cent. greater extraction of juice was possible than with the wooden mills.

7. *Introduction of Shillong potatoes.*—With a view to introduce superior varieties of Shillong potatoes and at the same time to test big sized seeds against small sized ones, a number of demonstrations was organised and some 40 maunds of seed potatoes were distributed for the purpose. The results are tabulated below :—

Nature of tests.	Number of tests.	Yield per acre.		Yield per acre, Shillong varieties.		Remarks.
		Shillong.	Country.	Big sized.	Small sized.	
1	2	3	4	5	6	7
Variety ...	3	6,836	6,493	...	...	North Sylhet.
Size tests ...	2	...	...	11,265	8,428	
Variety ...	7	5,601	5,639	...	...	South Sylhet.
Size tests ...	4	...	...	10,992	9,755	
Variety ...	6	4,232	2,240	...	...	Karimganj.
Size tests ...	4	...	...	5,197	5,995	
Variety ...	3	4,260	3,747	...	...	Habiganj.
Size tests ...	2	...	...	11,472	9,089	
Average ...	...	5,232	4,530	9,931	8,316	for the whole district

From the above figures it is apparent that the Shillong potatoes are much better croppers than the country or Bholaganj potatoes and that the big sized seeds are more economical than small ones.

8. *Jute demonstrations*.—Kakaya Bombai jute of the Bengal Agricultural Department was introduced in Sylhet in the year 1916 and since then it has been rising in general popularity throughout the district. Results of variety and manurial tests organized in 1918 are to be seen below. In addition a number of small packets was distributed free for popularising this variety among cultivators who had no previous experience of it, but unfortunately most of the crops were spoiled by the heavy flood.

Kind of demonstration.	Average number of demonstrations.	Average increase over the country variety.	Average increase over the untreated plots in pounds per acre.	Remarks.
1	2	3	4	5
Variety	2	710	...	North Sylhet.
Bonemeal manured ...	2	...	189	
Variety	2	425	...	Habiganj.
Bonemeal	2	...	166	
Water Hyacinth ash ...	2	...	144	
Bonemeal and hyacinth...	1	...	256	

As the cost of the manures used was Rs. 10 per acre and the average value of the extra crop produced was about Rs. 20, these may be looked upon as satisfactory, especially as some residual value of the manures will remain behind.

9. *Trials with new crops*.—Groundnuts were tried at 44 centres throughout the district. At 30 of these centres, though the crops grew very luxuriantly at the beginning, they succumbed later to heavy rains. The average outturn per acre from the plants which completed their growth properly was 1,002lbs. and the average seed rate was 50lbs.

The season for cold-weather demonstration in general was very unfavourable, owing to the fact that the rains continued late. Moreover the unusually long drought that followed soon after sowing prevented satisfactory growth of these crops.

The results of a few of the more satisfactory tests are given below :—

Name of crops.	Seed rate.	Yield obtained.	Remarks.
1	2	3	4
	lbs.	lbs.	
Wheat	116	2,113	
Barley	146	1,995	
Khesari	38	290	
Masuri	29	419	

Assam mustard, large grained linseed from Calcutta and Bhengi, tobacco from Rangpur, were tried against the local varieties.

Name of crop.	Increase over the local variety, in pound, per acre.
Assam mustard	103
Calcutta linseed	47
Rangpur tobacco	70

(The results of three tobacco plots are not yet available, as the leaves are still in the process of curing).

Gandhi sail, a very late variety of soil from the Mymensing district, was tried with success and the yield per acre was 984 lbs.

10. *Miscellaneous*.—The use of the Meston plough was demonstrated on jute areas and tried on potato plots in North and South Sylhet and Karimganj. Several cultivators have promised to purchase next year, but no sales have yet been made, probably owing to the high price of these ploughs as compared with local ploughs.

Manure pits and sheds erected in the several subdivisions are shown below :—

Karimganj ... ..	...	...	3
North Sylhet ... ..	...	...	4
South Sylhet ... ..	...	...	3
Hailiganj ... ..	...	...	8

This important work is not being carried out so energetically; it might be and greater attention must be devoted to it in future.

11. The Agricultural demonstrators at Barleka, Sylhet, haistaganj and Maulvi Bazar were on tour for 122, 138, 85 and 44 days, respectively. These demonstrators have worked well. The death of Demonstrator Sanat Kumar De is deeply regretted, during his short term of service in Kulaura circle, he had proved most promising.

12. Agricultural Inspector Babu Benode Behari Das worked satisfactorily under somewhat difficult circumstances.

Agricultural Inspector Babu Profulla Chandra Dutta shows energy and intelligence and is a promising officer.

AGRICULTURAL DEMONSTRATIONS IN CACHAR PLAINS.

13. Agricultural Inspector Srijut Lalit Mohan Das was in charge of the demonstration work in the Cachar plains till early 1 January 1919 when on his transfer to the Assam Valley charge was taken over by Babu Kamini Kumar De.

During the greater part of the period there was only one demonstrator to assist in the work, but towards the end of it a second man was appointed, and the district divided into the two circles, Silchar and Hailakandi.

The Agricultural Inspector Srijut Lalit Mohan Das was on tour for 125 days, Agricultural Inspector Babu Kamini Kumar De for 52 days from the time he took over charge in January, and the demonstrator for 242 days for the period under report.

14. Kinds of demonstrations—

- (a) Paddy manual tests.
- (b) Trial with superior varieties of paddy.
- (c) Introduction of superior varieties of sugarcane and 3 roller iron mills.
- (d) Introduction of Shillong potatoes.
- (e) Trials with new crops :—
Groundnuts, jute, cereals, pulses and oilseeds.

(f) Miscellaneous—Trials with Meston plough, conservation of cattle manure in covered pits in sheds.

15. Paddy manurial demonstrations laid down in 1918 comprised :—

(a) Bonemeal used alone, (b) Bonemeal with ground limestone, (c) Dhaincha green manuring, and (d) Dhaincha with ground limestone.

Except on one or two cases the paddy manurial tests on *chhasi* land have not shown any appreciable results, and those which did so are not very convincing.

16. On the whole on *dofasi* lands the results are good.

Bonemeal was applied at the rate of 3 maunds (247 pounds), limestone 10 maunds (823 pounds) and dhaincha seed sown at the rate of 30 pounds per acre.

The average yields from each kind of treatment and the costs thereof are given in the following abstract :—

Treatment,	Number of demonstrations.	Average increase in output.	Value of the increased crop at Rs. 28-0 per maund.	Cost of manuring.	Profit or loss.	Remarks.
1	2	3	4	5	6	7
			Rs. a. p.	Rs. a. p.	Rs. a. p.	
Bonemeal	3	339	10 5 0	9 0 0	1 5 0	<i>Chhasi</i> land.
	4	868	27 1 0	9 0 0	18 1 0	<i>Dofasi</i> „
Bonemeal and limestone	2	727	22 3 0	19 0 0	3 3 0	
Dhaincha green manuring	3	354	10 12 0	1 12 0	9 0 0	
Dhaincha and limestone	1	76	2 2 0	11 12 0	9 10 0	

The above demonstrations were distributed over the following centres :—Banskandi and Lakhirband in Hailakandi and Ramnagar, Topekhan, Joynagar and Kashipur in Silchar.

17. The residual effect of bonemeal, bonemeal and dhaincha, and dhaincha green manuring applied in 1917 were observed by weighing the crops produced in 1918 from the plots so treated. The results will be found in the abstract given below :—

Details of demonstration.	Increase in 1918.	Increase in 1917.	Total in- crease.	Value of total increase at Rs. 2-8-0 per maund.	Cost of manuring.	Remarks.
	In pounds per acre.					
1	2	3	4	5	6	7
				Rs. a. p.	Rs. a. p.	
Average of bone- meal demonstration.	434	594	1,028	31- 5 0	9 0 0	
Average of dhaincha green manuring demonstration.	611	631	1,142	34 13 0	1 12 0	
Average of bone- meal and dhaincha demonstration.	453	268	721	22 0 0	10 12 0	

The above demonstrations were distributed over the following centres :—Lakshirband, Boolipar, Banskandi and Lakhipur and the results are quite satisfactory.

18. With a view to introduce superior varieties of paddy, a number of trials was carried out at various centres. George *sail* introduced by Srijut N. C. Barua, Honorary correspondent of the Department, and Indra *sail* by the Bengal Department were tried against the best local varieties. As the crops were planted at different times and somewhat late in the season and as the earlier planted crops were damaged by flood, the figures have little experimental value. With a larger staff and closer supervision more decisive results should be obtained in the present year from the large number of demonstrations which are now being organised.

19. In sugarcane the record is poor and discouraging. Out of 30 demonstration plots only a half dozen can show some trace of the superior varieties. Sugarcane in general suffered greatly from the continuous and excessive rain after planting and it is generally reported that no after cultivation was possible. Under the circumstances it is expected that not more than 100 or 200 sets will be returned instead of a number equal to that supplied last year. In spite of the many difficulties, it is pleasing to

observe that where these canes were once introduced, they have established their superiority over the local varieties. Arrangements have been made to distribute a further supply of sets from the Assam Valley, and it is hoped that next year there will be sufficient sets available for future distribution from those now introduced.

The three-roller iron mills was demonstrated with some success at several centres. The fact that there are already two roller iron mills in the district makes it more difficult to introduce the three-roller mills, especially at the present price of Rs. 80 or over.

20. *Introduction of Shillong potatoes.*—With a view to introduce superior varieties of Shillong potatoes and at the same time to test big sized sets against small sized sets, a number of demonstration was organized at various centres, and some 30 maunds of seed potatoes were distributed for the purpose.

The results of these tests are given below :—

Nature of tests.	Number of sets.	Yield per acre, in pound.		Yield per acre, in pound, Shillong varieties.		Remarks.
		Shillong.	Country.	Big sized seeds.	Small sized seeds.	
1	2	3	4	5	6	7
Tests ...	5	3,429	3,460	...	...	An average outturn of 40 maunds to the acre of the Shillong varieties is very poor.
Size tests ...	3	...	...	3,898	2,505	

From the above it can be seen that the introduced varieties have proved no better than the local variety. The reason probably is that as the former have larger tops and broader leaves, they get rid of more moisture by transpiration and so suffer to a much greater extent from the drought than the smaller leaved and hardier local varieties, especially as irrigation is little practised.

The size tests clearly indicate that it is poor economy to plant very much small sized sets, as is the common practice with the cultivators of the province.

21. Trials with new crops:—

- (a) *Fodder*.—Jawar was tried, but on account of heavy rain following immediately after sowing, the seeds failed to germinate.
- (b) Groundnuts were tried at a number of places, but many of the plots suffered from water-logging, and some from disease. These grown on highlands in Hailakandi and at Katigara did much better and gave very profitable crops. Winter crops were unsatisfactory in most cases; the average yields obtained from seeds sown at different places are shown below:—

Name of crop.			Seed sown.	Yield obtained.
			Pounds.	Pounds.
Wheat	...	...	22	110
Barley	...	...	4	20
Oats	...	...	2	8
Khesari	...	...	41	108
Masuri	...	...	4	40
Assam mustard	...	...	4	41

The results of the Assam mustard are encouraging and the tests will be repeated.

Large grained linseed obtained from Calcutta has not shown any superiority over the local smaller grained variety.

The demonstrators appear to have made few, if any, attempts either to introduce the Weston plough or to induce the cultivators to prepare covered manured pits or sheds. These matters must receive more attention in future.

The Agricultural Inspector purchased and supplied seven gur boiling pans to the Assam Valley at an average price of Rs. 26 each.

The Agricultural Demonstrator Munshi Ajrumand Ali worked well.

REPORT ON THE SYLHET SEED DEPÔT FOR THE YEAR ENDING 31st MARCH 1919.

22. The seed depôt is accommodated in a corrugated iron building which is situated on the south bank of the Surma river, close to the Sylhet ghat railway station. The situation is an excellent one, but it is possible that the building will prove too small as the work develops.

The Superintendent of Agriculture, Surma Valley, is in charge of the seed depot and is assisted by a clerk. A chaukidar is also employed. He lives in quarters attached to the building.

Maulvi Fazlal Haq Ahmed took over charge from October 1918 on his transfer as Superintendent, Surma Valley. Although the building was rented and preliminary arrangements were made from June, no actual business transactions took place until October. In the six months ending 31st March 1919, seeds, manures and implements to the value of approximately Rs. 5,500 were dealt with. The most important items were Shillong seed potatoes 194 maunds, pulse seed 56 maunds, linseed and other oilseeds 50 maunds, paddy 24 maunds, jute seed $13\frac{1}{2}$ maunds, cereals and miscellaneous seeds about 5 maunds, bonemeal sold in the Khasi and Jaintia Hills 570 maunds, other manures about 10 maunds, iron sugarcane mills seven. Out of 194 maunds of Shillong seed potatoes, 93 maunds 35 seers were sold to the public at Rs. 4-14-0 per maund including price of sacks, producing a sum of Rs. 457-8-6, 15 maunds worth Rs. 71-4-0 were sold to Honorary Correspondents at half price, 64 maunds worth Rs. 304 were used for demonstration purposes, and the balance of about 21 maunds was lost through dryage, rotage and difference on re-weighment. The total value of potatoes thus disposed of comes to Rs. 832-12-6, while the total cost was Rs. 828-7-3. The percentage of loss is somewhat heavy, but it is hoped that this loss may be avoided in future by better arrangements for smaller consignments and prompt distribution.

The circular on the cultivation of pulse crop issued by the Agricultural Department towards the end of the rains of 1918 created considerable interest, with the result that there was a demand for such seeds from every part of the valley. Khesari and masuri were most in demand, $23\frac{1}{2}$ maunds of the former and $25\frac{1}{2}$ maunds of the latter were sold for seed purposes, and a small balance of $5\frac{3}{4}$ maunds were sold as dal. The seeds were first class and germinated well, but on account of excessive drought the crop in many cases failed to produce seed.

The linseed was supplied to the order of the Deputy Commissioner for flood relief cultivation in the Kanairghat district.

Arrangements were made through the seed depot for the supply of 1,450 maunds of bonemeal to the Khasi and Jaintia Hills. A total quantity of 570 maunds was sold up to the close of the year. The price realised up to the end of the year was Rs. 2,416-6-4 and the greater part of the balance has since been disposed of. The sale prices have been fixed at Rs. 4-2-0 and

Rs. 5-6-0 per maund at Shillong and Jowai, respectively, which is only very slightly more than the cost of delivering the manure to the cultivators.

The fact that the staff knew little of the district or of the work, made the establishment of the depot somewhat difficult, but notwithstanding these difficulties good start has been made in the six months during which business has been carried on.

The accompanying balance sheet shew a loss of Rs. 2,195-2-4, but the greater part of this apparent loss is made up of capital expenditure on the purchase of furniture and fittings and of the carriage paid on them. The remainder of the loss is due to the fact that it was found necessary to stock small quantities of various seeds which had to be procured from long distances and on which passenger freight rates had frequently to be paid and that these seeds were supplied at unremunerative rates.

Statement showing the working of the Sylhet Seed Depot for the year ending 31st March 1919.

Assets or receipts.		Liabilities or charges.	
1	2	3	4
	Rs. a. p.		Rs. a. p.
Total amount realized from sale in year under report.	3,566 0 10	Rent	225 0 0
		Establishment	204 7 0
Add bills outstanding ...	359 12 9	Furniture	1,298 9 6
		Contingencies	1,173 5 6
Value of stores supplied free or at concession rates to Honorary Correspondents and farms and for demonstration purposes.	1,446 4 5	Depreciation in value of stock in hand at 10 per cent. of cost price.	129 15 7
		Cost of purchasing stores	5,240 15 4
		Cost of stores supplied free from farms, etc.	594 11 4
	5,372 2 0		8,867 0 3
Profit and Loss Account...	2,195 2 4	Cost price of stock in hand on 1st July 1919.	Nil.
		Cost price of stock in hand on 31st March 1919.	1,299 11 11
Total ...	7,567 4 4	Total ...	7,567 4 4

23. *Water Hyacinth*.—This pest continues to spread in the low-lying district of the Surma Valley, where it appears to have established itself four or five years ago. It may have arrived there earlier but does not appear to have been definitely recognized until about the time mentioned.

With a view to checking the spread of the weed, experimental work was started in the previous year and continued in the present one, the object being primarily to destroy the weed and at the same time to find out something of the value of the ash as manure, and to gain information as to the probable cost of the work of eradication. In the cold weather of 1917-18 a small quantity of ash was prepared which on analyses showed from 9 per cent. to 12 per cent. of potash. Part of this ash was sent to tea planters, and was applied by them to green manure crops grown among tea. Another portion was used for experimental manuring of jute, and the remainder was sent to a Calcutta merchant. The material gave good results on green manure crops and on jute, but the Calcutta firm reported that they could not utilize this low grade material in their preparations. As this ash contained potash almost equal in quantity to Kainit, one of the German potash manures which had an extensive sale in European countries in pre-war times, it was thought that something might be done towards utilizing the ash on a considerable scale within the province, and accordingly the work was continued in the past cold weather 1918-1919. A total quantity of 678 maunds of ash was prepared. Somewhat less than one-third of this was produced under the direct orders and supervision of our agricultural officers and the balance by two landowners of Chhatian in Habiganj subdivision. Arrangements were entered into with several tea planters in both the Surma and Assam Valleys to purchase the material at a price based on the potash content as shown by analysis. The Traffic Manager of the Assam-Bengal Railway was approached and was good enough to give specially low freight rates for its transport. Samples were taken by a responsible agricultural officer, as the material was filled in the railway wagons, and these samples were analysed by the Agricultural Chemist to the Assam Administration. The figures supplied by him are now to hand and have been found so low $3\frac{1}{2}$ per cent. to 6 per cent., as to preclude any possibility of local landowners or cultivators finding the preparation and supply of the ash a profitable business, unless as part of a scheme for clearing the lands and water courses of the district. From the planters' point of view also, it will be unprofitable to purchase and pay handling and freight charges on such low grade material.

The average cost of preparing the ash under departmental supervision, where all labour had to be paid at current rates, was Re. 1-9 per maund, while when done by the landowners or rather by their cultivators, the cost is reported to have been about twelve annas per maund. In the latter case much of the work of collecting the weeds was done free by the cultivators when preparing the lands for ploughing, while in the former the weeds were removed from tanks and water courses, often to a considerable distance, and dried and burned by paid labour. The average cost of preparing and delivering to the purchasers this total quantity of 678 maunds handled was Re. 1-10 per maund, while the average price realized will only amount to Re. 1-1 per maund.

Inquiries were made on the spot regarding the methods adopted by the Bengal Department to prepare a concentrated potash salt from the ash of the water hyacinth weed, and it was found that the financial return was only about half of the expenditure when this method is adopted. From the foregoing it will be seen that, even under the most favourable conditions of marketing and transport, it will not be possible either to produce an ash of commercial value or to prepare a concentrated salt without spending considerably more than the value of the produce and that if eradication is ever to be attempted, it must be on other than a direct profit paying basis. In the infested tracts large quantities of the weed are used for fuel: during flood time when fodder is scarce or non-existent green weeds are used, one can hardly say, for fodder—but for keeping the cattle alive. Weeds which have to be removed from lowlying lands to permit of cultivation are generally burned and the ash used as a manure. As a result of departmental interest in the question, the use of the ash or of the rotted plants as manure is spreading widely in infested tracts with the result that the spread of the weeds is being checked to some extent.

Work done by Honorary Correspondents.—Mr. D. Ferguson of Dhamai tried Kakaya Bombai jute of which he produced an excellent crop. The crop was kept for seed, and the seed has since been distributed among cultivators in his area. He also tried hyacinth ash as a manure and cold-weather fodder crops of oats, peas, etc., and reports that fodder crops were a failure owing to the extremely dry cold weather.

Babu Joynath Nandi of Bejura gave the Agricultural officers great assistance in hyacinth ash work. He distributed Shillong seed potatoes among his raiyats and neighbours and tried several pulse crops in the cold weather with a certain amount of success.

AGRICULTURAL DEMONSTRATIONS IN THE KHASI, AND JAINTIA HILLS DISTRICTS.

24. U Harry Singh was in charge of demonstration work in the hills until the end of December 1918. During the greater part of that time Mr L. L. Reade was under training with him, and he took over full charge from the former on 1st January 1919. When the transfer was made, U Harry Singh took over charge of the Upper Shillong Farm for two months while the Farm Manager was on leave and completing that duty he was appointed to the newly created post of Fruit Inspector for Assam. During the period under report U Harry Singh was on tour 107 days, most of which was in connection with his duties as Agricultural Inspector. Mr. Reade was on tour for a total of 115 days from the date of his appointment on 20th July 1915. During his period of training the greater part of his attention was taken up with the purchase and despatch of seed potatoes to the plains districts and, after his appointment, he had to spend a good deal of time in connection with the distribution of one thousand maunds of bonemeal most of which he succeeded in selling to Khasi cultivators before the end of the period. Assistance in demonstration work is given by four demonstrators headquartered at Shillong, Mawphlang, Umran and Jowai, respectively.

25. *Rice*.—The majority of rice-growers in the more conveniently situated tracts have realised the value of bonemeal for wet-land paddy. Fresh demonstrations have therefore been carried out in more remote places : altogether demonstrations were arranged in 8 centres as compared with 2 in the previous year. As in previous years two plots, each about $\frac{3}{4}$ acre in area were taken in each centre. One was manured with bonemeal at the rate of 3 maunds (247 lbs.) per acre, and the other left untreated as a check.

The first year's results are given in the following table :—

No.	Locality.	Cultivators.	Yield of grain in lb. per acre.		Increase in lb. per acre.	Remarks.
			Bonemeal plot.	Untreated plot.		
1	2	3	4	5	6	7
1	Barapani	D. Ropmay	1,589	788	801	
2	Umpih	Willing	1,353	1,119	234	
3	Mawphlang	Ka Kyriup	1,254	1,047	207	

No.	Locality.	Cultivators.	Yield of grain in lb. per acre.		Increase in lb. per acre.	Remarks.
			Bonemeal plot.	Untreated plot.		
1	2	3	4	5	6	7
4	Nongkhaw ...	Sumar ...	1,527	1,056	471	The owner was unable to look after his field through illness (Influenza) and the crop was destroyed by cattle.
5	Sohshrieh ...	Rang Maseek ...	1,695	820	875	
6	Jarain ...	Kat Ling ...	984	738	246	
7	Lyngkien ...	Kit ...	1,793	1,504	399	
8	Pynthorumkbrah...	Kpa U Moid ...	...	...	...
Average yield per acre ...			1,458	987	470	

The average increase in crop due to bonemeal is, therefore, 470 lbs per acre. Valuing this grain at Rs. 4 per maund of 82.3 lbs. and the bonemeal at Rs. 4-12-0, the net profit per acre works out at Rs. 8-9-6 for the first year of application. Any increase obtained in subsequent years will be pure profit, and experience shows that bonemeal favourably affects the crop for at least three years. These plots are being kept under observation as to the second and third years' results of the initial dressing of bonemeal.

Second year demonstrations.—The two demonstrations laid down in 1917, of which the first year's result appeared in last year's report, were kept under observation without further manuring, and the results of the second year appear below.—

No.	Locality.	Cultivators.	Yield of grain in lb. per acre.		Increase in lbs. per acre.
			Bonemeal plot.	Untreated plot.	
1	2	3	4	5	6
1	Myinthloo ...	Sahmaji ...	1,248	682	566
2	Pamra ...	My'lon Dykhar ...	1,586	828	758
Average yield per acre.			1,417	755	662

1:0

This average increase of 662 lbs. is worth Rs. 32-2-9 at current prices.

These demonstrations yielded an average net profit of Rs. 2-14-9 per acre in the first year, after charging the entire cost of bonemeal to that year. The total net profit per acre from the first two years of this series of the demonstrations, therefore, averages Rs. 35-1-6.

Third year demonstrations.—The 5 centres commenced in 1916, of which the first and second year's results appeared in the reports for 1917 and 1918, were kept under observation for the third year. The demonstration plot in one centre was not cultivated through the owner's illness. The following yields were obtained from the remaining four demonstrations :—

No.	Locality	Cultivators.	Yield of grain per acre		Increase in lb. per acre.	Remarks.
			Bonemeal plot.	Untreated plot.		
1	2	3	4	5	6	7
1	Nongthymmai...	U Noni ...	1,031	862	169	Not cultivated through illness.
2	Lumpengdeng ...	U Hinmoney ...	...	...	...
3	Mawthoh ...	U Khai ...	1,626	1,426	200	
4	Um-iap ..	Ka Nesi ...	1,102	1,017	85	
5	Myriaw... ..	Siem Myriaw...	1,035	951	84	
		Average yield per acre.	1,198	1,064	134	

These four centres show an average increase of 134 lbs. of grain from the plots manured with bonemeal. This at current rates is worth Rs. 6-8-7. These centres showed an average net profit per acre of Rs. 14-5-5 for the first two years. The total net profit for the three years for which these demonstrations have been carried on is, therefore, Rs. 20-13-0, on an initial expenditure of Rs. 13-8-0 per acre.

During the year fresh demonstrations with bonemeal for upland paddy have been carried out in 12 centres, 4 centres in each of Shillong, Mawphlang and Jowai circles. The selected plots were as nearly as possible $\frac{1}{4}$ th acre each. One plot was manured with bonemeal at the rate of 3 maunds = 247 lbs. per acre and another was left untreated for comparison.

The first year's results are given in the following table :—

No.	Locality.	Cultivators.	Yield of grains in lbs. per acre.		Increase in lbs. per acre.
			Bonemeal plot.	Untreated plot.	
1	2	3	4	5	6
1	Undyangka ...	U Snagap ...	960	906	54
2	Nongmasi ...	U Sad ...	1,440	1,280	160
3	Mawdatbaki ...	U Drain ...	656	525	131
4	Unjajew ...	U Sch ...	991	910	81
5	Bangshken ...	Ka Li ...	873	786	87
6	Sohiong ...	U Hirsken ...	1,026	913	113
7	Nongmasi ...	Ka Lili ...	1,130	886	234
8	Ma long ...	Ka Fu ...	1,106	853	253
9	Jowai ...	U Thule ...	352	320	32
10	Wahajer ...	U Jen ...	1,421	1,280	141
11	Nonglah ...	U Khiaw ...	480	400	80
12	Mawpant ...	U Sfait ...	256	240	16
		Average yield per acre.	860	775	115

The effect of bonemeal on dry land paddy is not so marked as it is in the case of wet-land paddy. From the average results obtained in these 12 demonstrations it will be seen that 247 lbs. of bonemeal has produced an extra crop of 115 lbs. of grain. This is not sufficient to pay the initial cost of manure, and the

results of some of the second year's demonstrations which are now recorded also show a very small increase.

Second year demonstration.—The 12 centres commenced in 1918, of which the first year's results appeared in the report of last year, were kept under observation for the second year.

At five centres the owners of the lands on which demonstrations were made were unwilling to continue the demonstrations, as little effect was seen on the first crop. One demonstration at Pynthorlangtein was damaged by rain and the results thereof were not recorded. The results obtained from the remaining six centres for the second year are given in the following table:—

No.	Locality.	Cultivators.	Yield of grains in lb. per acre.		Increase in lbs. per acre.
			Bonemeal plot.	Untreated plot.	
1	2	3	4	5	6
1	Umlyngka	... U Then ...	658	518	140
2	Umlane	... U Sing ...	500	303	197
3	Talong	... U Tata ...	450	302	148
4	Shymang	... U Suna ...	410	209	201
5	Rymbai	... U Doloi ...	510	266	244
6	Mawstem	... Ka Bi ...	686	510	176
7	Pynthorlangtein	... U Dabid ...	...	...	Damaged by rain.
		Average yield per acre.	535	351	184

From the above figures and taking the average results obtained from the demonstrations for the first and second year it will be found that 247 lbs. of bonemeal produced an extra crop of 325 lbs. of grain, which is worth about Rs. 14 at the average rates. This leaves a small profit of about 0-8-0 (eight annas only) on an initial expenditure of Rs. 13-8-0 per acre. The results obtained are not so marked as to encourage the cultivators to use the manure, and to continue the demonstrations on the same lands.

Third year demonstrations.—Only three out of the seven cultivators with whom these demonstrations were laid down in 1918

could be persuaded to continue the demonstrations for the third year, and the results obtained from the 3 centres are given in the following table :—

No.	Locality.	Cultivators.	Yield of grains in lbs. per acre.		Increase in lbs. per acre.
			Bonemeal plot.	Untreated plot.	
1	2	3	4	5	6
1	Mylliam ...	U Tim ...	319	309	10
2	Umjaiso ...	U Hon ...	358	298	60
3	Langlibun ...	U Sahon ...	415	300	115
		Average yield per acre.	361	302	62

From the above figures and taking the average yield of 351 lbs. obtained for the first and second years the total extra crop comes to 413 lbs. of grain, produced from the plots manured with bonemeal three years ago. This at the average rates for three years is worth Rs. 16-10-8, on an initial expenditure of Rs. 13-8-0, leaving a net profit of Rs. 3-2-8 only after the third year crop.

Judging from the figures above and the experiences of our demonstration staff during the three years it has to be admitted that the increase of crop due to bonemeal in the three years is not of a sufficiently high order to encourage the cultivator to use manure for upland paddy.

With the object of trying to improve the outturn of upland paddy in the districts, it is proposed to take up demonstrations with bonemeal and a soluble Nitrogenous manure in the present year.

At one centre in each of Shillong, Mawphlang and Jowai circles, a former wetland paddy demonstration was redressed with bonemeal. These demonstration plots were manured with bonemeal in 1914 and received no manure in the intervening years. The effect of this second dressing of bonemeal on the third year's crop will be seen from the accompanying table:

No.	Locality.	Cultivators.	Yield of grains in lbs. per acre.		Increase in lbs. per acre.
			Bonemeal plots.	Untreated plots.	
1	2	3	4	5	6
1	Shangpung ...	Smon Dhar ...	1,019	757	262
2	Umlyngka ...	Kpa Ka Kwai ...	1,690	1,430	260
3	Mairang ...	Kmie Ka Selina ...	1,189	885	304
	Average ...	...	1,299	1,024	275

These results indicate that a second dressing of bonemeal applied three years after the first dressing gives a profitable return. The average total increase obtained in the first and second and the third year was 1,022 lbs. Valuing the grain at the average rates Rs. 3-5-4 per maund and the bonemeal at Rs. 4-8-0 the net profit per acre works out at Rs. 29-1-4.

26. *Bone-crushing operations and bonemeal distribution.*—The total receipt of raw bones during the year was 1'37 tons. A consignment of 1,450 maunds=53'3 tons of bonemeal was purchased in Calcutta for the hills. About half of this was sold up to the end of the period under report, the greater part of the balance has since been sold and it is expected that the whole consignment will be disposed of in the course of a very short time. The demand is exceptionally keen from Shillong, Mawphlang and Jowai circles, and a much larger quantity could have been sold in the present year had it been available.

27. *Potato growing.*—During the year under report seed potatoes were distributed as follows:—

	Tons.	
From Ladmawphlang depôt ...	29	} For the Hill districts.
" Shillong "	18	
" Upper Shillong Farm (on return system) ...	5'79	
For Brahmaputra Valley ...	28'71	} For the plain districts.
" Surma " ...	7'18	
Total ...	42'15	= 1,150 maunds.

Demonstrations for winter potatoes were carried out in five centres in the Umrán circle, where practically no summer crop is cultivated. One maund of seed was planted at each centre with the following results:—

No.	Locality.	Name of cultivators.	Yield in lbs. per 1 md. seed.	Remarks.
1	2	3	4	5
1	Umsning ...	Kpa ka Le ...	248	Damaged by frost.
2	Umrán ...	„ Bar ...	...
3	Umsaw ...	„ Hom ...	186	
4	Nong Khyllém ...	„ Bedi ...	168	The crop was attacked by ants.
5	Nongpoh ...	Basir Ahmed ...	320 lbs.	

During the year the frost was exceptionally heavy in the Bhoi country damaging the potato crop demonstrated at Umrán.

The results from the remaining 4 centres are promising. The demonstrations are being continued in the present year.

Spraying with Bordeaux mixture.—Owing to the extremely high price of materials no demonstrations were carried out in the past season. It is proposed to take up the work again when prices become more normal.

28. *Ploughing demonstrations.*—Ploughing demonstrations with the Meston plough were carried out in five centres at Myllem, Barapani, Mawphlang, Umrán and Jowai.

The plough is too light for dry land cultivation, but it is found more useful for wet cultivation than the country plough. The demonstration with the improved plough will be continued. Requisitions for the purchase of these ploughs are being received.

29. *Insect-pests.*—Rice pests, viz., rice-case worms appeared in the district during the year. Remedial measures were taken by our staff and the ravages of these pests were successfully checked at three centres by the following means:—The water in the affected field was covered with a film of kerosine oil and the insects were then disturbed by drawing a rope across the affected plots. When so disturbed these insects drop into the water and are quickly killed by the kerosine oil.

30. *Grafting and pruning of fruit trees.*—This work was continued as in the previous years, demonstrations being given

by demonstrators from time to time on their tours. The following grafts were made in 16 villages :—

Oranges	...	Budded	...	272
Peaches	...	"	...	148
Pears	...	Grafted	...	114
Apples	...	"	...	10
Plums	...	"	...	128
Apricots	...	"	...	71
Total				743

Up to the present no signs of disease have appeared on the oranges so budded.

The following plants are being prepared at the Wahjain Tropical Plantation :—

Jamaica oranges	...	...	...	5
Natal "	...	...	...	3
Lichis	...	...	...	6
Mangoes	...	...	...	6
Cashew nuts	...	...	...	6
Total				26

Pruning of fruit trees was done in 24 gardens, including 17 in Shillong circle, 2 in each of Mawplang and Umran circles and 3 in Jowai.

31. *Supply of seeds, plants, etc.*—The following seeds, plants, etc., were distributed during the year :—

Plants :—

Pear grafts	...	...	...	43
Rhubarb Crowns	...	...	...	12
Asparagus "	...	...	...	12
Cryptomeria seedlings	...	...	...	437
Coffee	...	...	...	1,100
Fine apple suckers	...	...	...	1,800

Cuttings :—

Round pepper	...	...	...	162
Long pepper	...	...	...	162
Peaches	...	...	...	100
Pears	...	...	...	276
Grape vines	...	...	...	12
Figs	...	...	...	5

Seeds :—

Perilla Ocimoides	...	...	...	7½ lbs.
Buckwheat	...	...	...	78 „
Squash seeds	„	...	...	8 No.
Coffee seeds	...	...	...	20½ lbs.
Soy bean seeds	...	...	...	4 „
Sohphlang	...	...	...	10 „
Varieties of Arum (Ka shriew)	...	...	...	40 „
„ millets	...	...	...	3 „
„ job's tears	...	...	...	2 „
Vegetable seeds	...	...	...	200 packets.
Arrow root „	...	...	...	1 lbs.
Orange seeds	...	...	...	1 bl.
Garo Cotton	...	...	...	12 lbs.
Paddy seeds (from Mawsiat Khnam)	...	...	...	10 „

The following tools were supplied during the year :—

Secateurs	...	...	...	6
Fork	...	...	...	1

32. *Pan disease*.—The Imperial Bacteriologist, Pusa, visited Shillong and Cherrapunji in the year before last and procured diseased specimens of plants for investigations but no report has yet been received.

33. The following Botanical specimens were supplied during the year :—

Plants of ksetpharai (*Nepenthes Khasiana*).

Ditto Sohlang thrait (*Ganeltheri Fragrantis Sima*).

34. Demonstrations with Garo cotton have been carried out in four centres in the Jaintia Hills and two centres in the Bhoi country. The seed supplied was very unsatisfactory and only a few plants germinated in each centre. The bolls produced were superior to the local ones. Fresh demonstrations are being made in each of Shillong, Jowai and Umran circles.

Demonstrations with local well-reputed paddy seeds are being carried out at five centres in the Jowai circles, two centres in the Umran, and one centre in the Mawphlang circles. As the demonstrations in the Umran and one in the Jowai circles were practically destroyed by cattle the results are neglected. The

results obtained from 1 seer of seed used in each of the remaining five centres were as follows :—

Mawkaiaw	...	...	...	46 lbs.
Raliang...	...	...	...	40 "
Barata ...	...	...	...	69 "
Shiliang myntang	...	...	...	44 "
Nongemai	...	...	...	32 "

The results were promising in suitable localities; a little more seed has been distributed free during the year.

The owners of the seeds distributed and demonstrated last year have also propagated the seed as instructed, and their reports are satisfactory.

Fresh demonstrations are being made and more seed distributed during the present year.

Demonstrations with ground nut have been carried out in two centres in each of Shillong, Mawphlang, Umran and Jowai circles and the yields obtained from $\frac{1}{2}$ lb. of seed used in each centre vary from $1\frac{1}{4}$ pounds at Marbisu to $6\frac{1}{4}$ pounds at Thangrain.

The demonstrations were quite promising in suitable localities and fresh demonstrations are being made during the present year.

During the year under report U Gloshon Singh completed the course of training at the Upper Shillong Farm and has since been appointed as a Demonstrator in place of U Sabir Singh, whose services were dispensed with last year.

R. S. N. Biswas, Demonstrator of Shillong circle was on privilege leave for two months and U Sedro Singh, an apprentice at Upper Shillong Farm, acted as his substitute. R. S. N. Biswas was transferred to North Cachar Hills towards the end of the period and H. Pascalis, Demonstrator, North Cachar Hills, was transferred to Shillong.

Bone-grinding operations in the Khasi and Jaintia Hills for the period.—As the bonecrushing installation at Upper Shillong was out of order no bone-meal was prepared during the period and consequently only a very small quantity of raw bones was purchased. The machinery has since been repaired and bones are now being crushed for application to the present crop.

On the 31st March 1919 the stock of raw bones stood at 113 maunds 7 seers and of bonemeal at $10\frac{1}{4}$ seers. The total expenditure during the period was Rs. 1,607-5-0. This consisted mainly of the Calcutta cost, freight and other miscellaneous expenses for bonemeal purchased for demonstration purposes and for sale.

Formerly the Garo Hills formed part of the charge of the Agricultural Inspector, Khasi and Jaintia Hills, but for convenience of administration it has been handed over to the Agricultural Inspector of Goalpara from February of the present year.

Shillong,

The 14th May 1919.

}

J. W. MCKAY,

*Deputy Director of Agriculture,
Surma Valley and Hill Districts.*

GLOSSARY.

Kharif ...	...	...	The rainy season.
Rabi ...	...	...	The cold season.
Ratoon ...	...	...	The second year's sugarcane crop grown from plants put down in the previous year.
			Autumn rice.
Aus ...	...	...	Winter rice.
Sail ...	...	...	A shorts stemmed variety of deep water winter rice.
Asra ...	...	...	Sesbania aculeata.
Dhaincha ...	...	...	Vigna catianga.
Cowpea ...	...	...	Andropogon sorghum var. vulgare.
Jowar ...	...	...	Phaseolus mung var. radiatus.
Kalai ...	...	...	Lathyrus sativus.
Khesari ...	...	...	Lens esculenta.
Musur ...	...	...	Phaseolus mungo.
Mung ...	...	...	Cicer arietinum.
Gram ...	...	...	Coriandrum sativum.
Coriander ...	...	...	Raphanus sativus.
Radish ...	...	...	Brassica Campestris.
Rape ...	...	...	Phaseolus mungo var.
Matikalai ...	...	...	Dolichos biflores.
Kulthikalai ...	...	...	Medicago sativa.
Lucerne ...	...	...	Triticum vulgare.
Wheat ...	...	...	Avena Sativa.
Oats ...	...	...	Sacharum officinarum.
Sugarcane ...	...	...	Trifolium alexandrinum.
Beer seem ...	...	...	Clycine hispida.
Soy beans ...	...	...	Oriza sativa.
Paddy ...	...	...	Indigofera tinctoria.
Indigo ...	...	...	Arachis hypogaea.
Groundnuts ...	...	...	Crotalaria juncea.
Sunn Hemp ...	...	...	Coir lachryma.
Job's tears ...	...	...	Paspalum sanguinale.
Raishan ..	...	...	82½ pounds.
Maund	A system of cultivation consisting of paving and burning the surface.
Jhum	Panicum jumentorum.
Guinea grass	

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The rainfall, although below the average, was not well distributed and occasional heavy down-pours did considerable damage to crops. A severe drought in spring, followed by a few heavy showers in May and intense heat in June, induced conditions, favourable to potato rotting, and the crops suffered very badly from this cause, both in the field and during storage. The heavy rains in September also interfered with hay making. These heavy showers not only caused a diminution in the outturn of the crops, but washed the surface soil from the steep hill sides. A late frost in the spring of 1920 killed a considerable portion of standing sprouted potato and also checked the germination of the others.

Summary of work. 4. The work done during the year included :—

- (1) Trials of different varieties of potatoes.
- (2) Growing potatoes for seed.
- (3) Trials of new crops.
- (4) Fodder crops.
- (5) Cattle breeding.
- (6) Distribution of seeds, implements, etc.

5. The total number of varieties under trial in 1919 was the same as last year. Where possible each variety was planted in duplicate plots of $\frac{1}{8}$ th acre each. All the varieties were planted in March and harvested in August, and winter seed was used in each case. The land was manured with 11 tons cowdung and 823 pounds of rape cake per acre, and the crop was sprayed with Bordeaux mixture at the rate of 240 gallons per acre applied in two equal doses.

The outturns of the varieties for the last 12 years are given below.